APPLIED HYDRAULICS

NOVEMBER 1956

THE MAGAZINE OF FLUID POWER | Air Circuits — Electrical Controls

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Speed Control for a Broaching Machine/ 77

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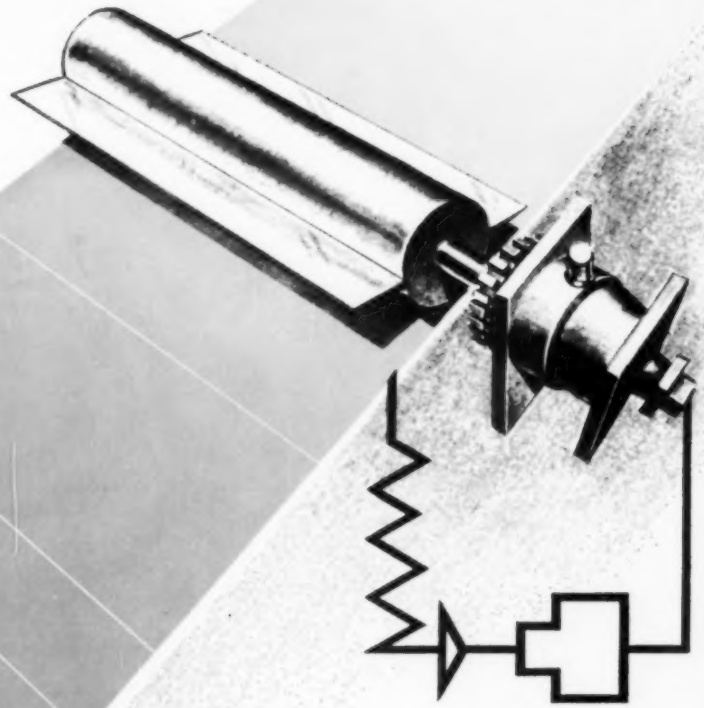

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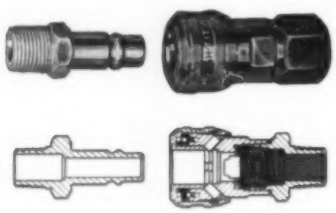
ELECTRONIC POSITION SERVO . . . page 67

For Information About
1957 PRIZE PAPER CONTEST
See page 24

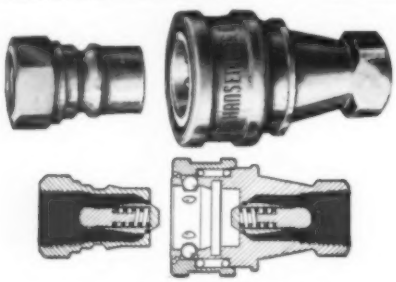
SPECIFICALLY ENGINEERED...
NEVER MERELY ADAPTED...
FOR EACH PARTICULAR
TYPE OF APPLICATION

HANSEN
QUICK-CONNECTIVE COUPLINGS



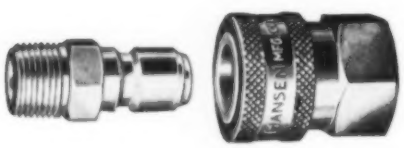
ONE-WAY SHUT-OFF
Shuts off one side of line

Gives quick connection and disconnection, with instant automatic flow or shut-off. To connect Coupling and open line to flow of fluid, merely push Plug into Socket. To disconnect, a slight pull on sleeve releases Plug and shuts off supply end of line.



TWO-WAY SHUT-OFF
Shuts off both sides of line

To connect, pull back sleeve and push Plug into Socket. Identical torpedo type valves permit free flow of gas or liquid through Coupling. To disconnect, pull back sleeve . . . Coupling immediately disconnects, valves automatically seal both ends of line. Female pipe thread connections from ⅛" to 1". Available in brass or steel.



STRAIGHT-THROUGH COUPLING

Provides quick connection and disconnection, but does not have shut-off feature. Sizes, ranging from ¼" to 2½", carried in stock. Two special types of straight-through steam Couplings also available—one for low pressures, and one for high pressures.

Quick-Connective Fluid Line Couplings for
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with Micrometer Accuracy

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SIZES ¼" • ⅜" • ½" • ¾"
TEMPERATURES to 250°F

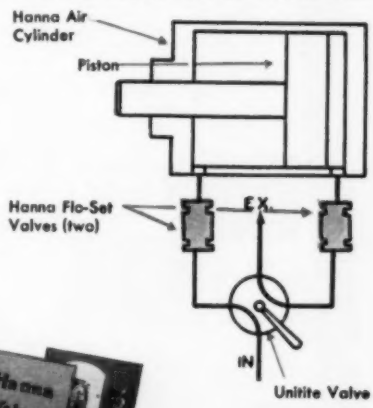
Hanna Flo-Set Valves are used to control cylinder piston speeds and operating speeds of many types of fluid actuated mechanisms. They are able to handle air, oil, water and many gases. When used with cylinders, these valves permit independent adjustments of forward and return piston speeds. The diagram at the right shows a typical circuit. Flo-Set Valves make the operation of air cylinders smoother and make cushioned cylinders more effective by building up essential back pressure.

Fluids pass unobstructed in the direction of the arrow on Hanna Flo-Set Valves. In the opposite direction, flow can be controlled from zero to full pipe capacity. One valve can be set to an infinite number of controlled flow positions. Once set, the position can be held by means of a locking collar. Established flow positions can be reset by using the micrometer graduations which accurately measure flow as a percent of full pipe capacity.

One revolution of the aluminum valve body will change the flow rate from zero to full capacity. No tools are necessary! In addition to the standard ¼", ⅜", ½" and ¾" sizes, there is a ¼" Jr. model, without micrometer graduations or locking collar, for light piping and tubing.

Typical Cylinder Circuit Using Hanna Flo-Set Speed Control Valves

Hanna engineers will gladly recommend circuits to help you with your applications.



Consult your classified telephone directory or Thomas' Register for your nearest Hanna representative. Write for Hanna Valve Catalog 254 and Flo-Set Valve Bulletin 253A.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

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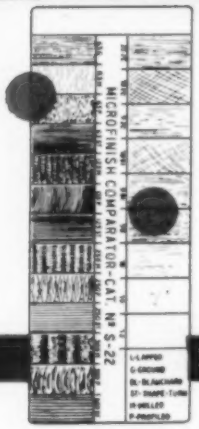
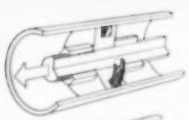
problem:

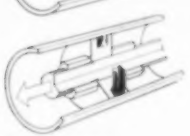


save money with a seal that needs only 60-100 micro-inch groove finish to replace O-rings that need 10-20.

new answer:

minnesota rubber's money-saving new





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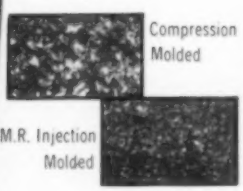
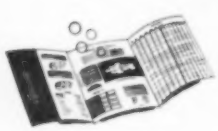
QUAD RINGS eliminate "spiral twist", a common cause of packing failure. At any pressure, less squeeze is required with QUAD RINGS than with O-rings. Truly effective sealing even for pressures as low as 0-5 psi. QUAD RINGS also give a positive seal under high vacuum. The 4-lip sealing surfaces reduce breakout and running friction—giving longer life. Seal perfectly even with a rougher groove finish.



Why Minnesota Rubber Seals Last Longer

QUAD RINGS are injection molded by exclusive Minnesota Rubber process. Result is increased resistance to abrasions and chemical actions due to unequalled high density. Evidence of greater density is shown here in cross sections of Standard Buna N compound, .027" x .019", magnified 240 diameters by University of Minnesota.



Free Samples and Data

Free samples of QUAD RINGS are available together with a descriptive brochure with technical information and installation data. QUAD RINGS are the result of intensive research and field testing. Made to closest possible dimensional tolerances. We urge you to inquire about this revolutionary new seal today.

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BPA

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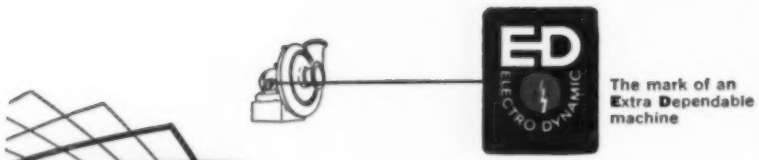
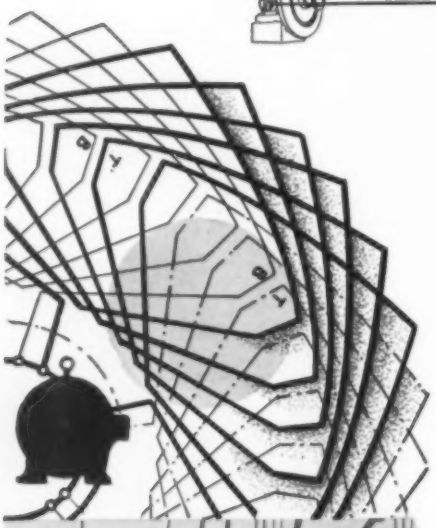
a better kind of power

FOR INDUSTRIAL MACHINES



The mark of an **E**xtra **D**ependable machine



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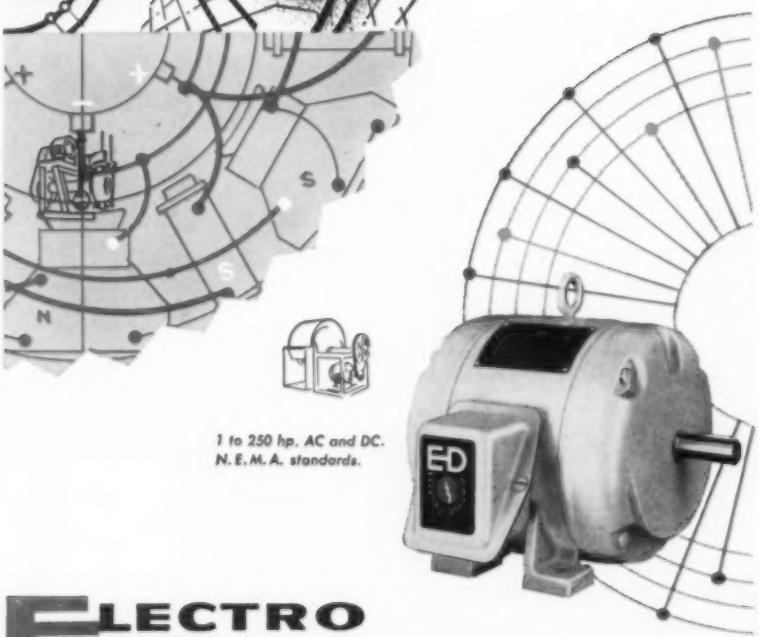

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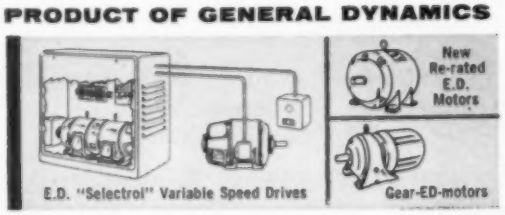

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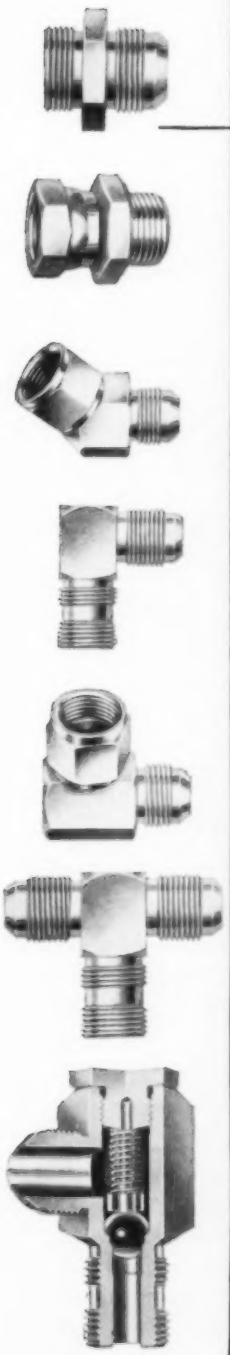

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Useful Literature

NEW ANCHOR SAE BOSS FITTINGS AND "O" RING ADAPTERS

A new Anchor Catalog has just been published, illustrating and describing this company's complete new line of SAE Boss Fittings and "O" Ring Adapters designed to satisfy the new SAE Straight Thread Boss Standards as shown on Page 825 of the 1956 SAE Handbook. A complete line of these new adapters is now offered in a wide range of sizes and styles. Also shown are the new Anchor Tube Nuts, available in Short Nut, SAE Long Nut and 3-Piece Assembly Styles.

Anchor SAE Straight Thread "O" Ring Boss Adapters are especially designed for use with the new SAE Boss. Positive, leak proof connections are insured by the "O" Ring seal. The need for excessive tightening is eliminated, and with it the danger of thread distortion, twisting strain, cracking and distorting of valve body seats, all of which are common causes for leaks.

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Ask for your copy of the new *Anchor SAE Boss Fitting Catalog.* Write to Anchor Coupling Co. Inc., 378 North Fourth Street, Libertyville, Illinois.

Fluid Power Lines

about Applied Hydraulics

LONG AND SHORT OF IT . . . This month's cover, illustrating the lead article, shows the production problem of automatically varying length of cut on web materials. AMF engineers have developed the automatic web cutting system described in Joseph Reed's article.

Joseph Reed

This design article presents the details of a servo system having great practical industrial value. The hydraulic circuitry is very simple. Its control is the key to successful operation.

Joe Reed, holds both electrical and mechanical engineering degrees. While with American Machine and Foundry Company, his work on servomechanisms for automatic machine control included development of the web cutter system. He recently joined General Precision Laboratories to do servo design work on aircraft computing systems.

VALVE DESIGNS . . . Askania Regulator's head of product development, W. G. Holzbock compares operating characteristics of three types of servo valves for industrial applications in an article starting on page 78. Operation, load characteristics, flow forces and linearity are discussed for the 4-way spool valve, baffle-and-nozzle valve and jet pipe valve.

BROACH CONTROLS . . . At a machine tool hydraulics forum last spring one of the discussions centered around control of broaching. Should feeds be powered electrically or hydraulically? Is quality of finish primarily dependent on broach tooth design? If the tool is properly designed will finish vary between a hydraulic feed and electrical feed? We're tossing these questions at you. To see what an all-hydraulic broaching machine does, take a look at pages 76 and 77.

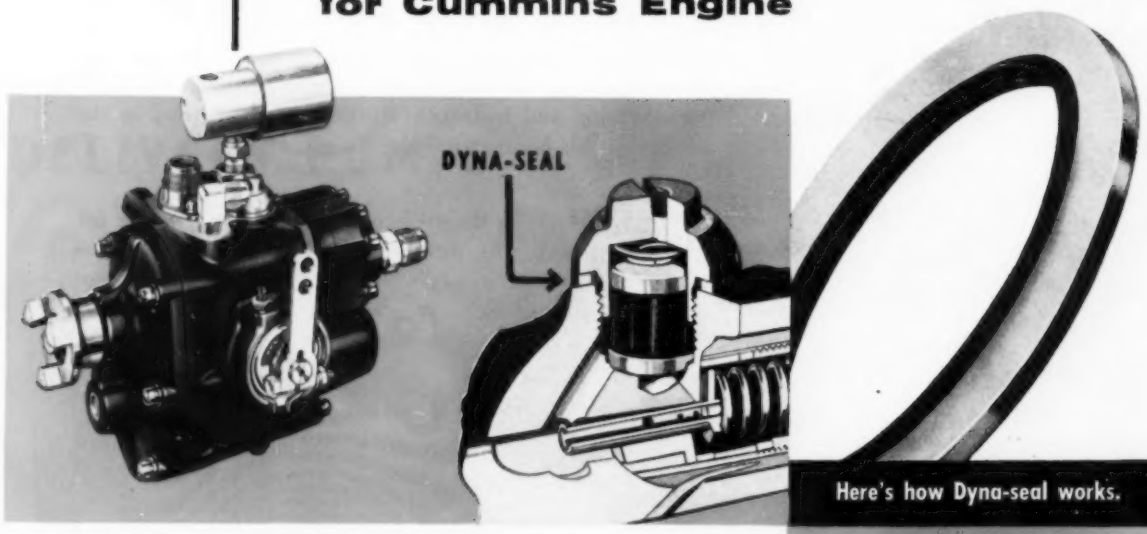
PUSHBUTTONS . . . Continuing AH's series of articles on electrical controls for fluid power systems, Allan Morris writes about pushbuttons in this issue. Part 2 on pushbuttons will be published in February. HPM's chief electrical engineer, Ken Rexford has written the February article.

NEW IDEA FOR SMALL PRESSES . . . The advantages of the differential circuit have been emphasized in many articles. One of the accepted disadvantages is the increased pipe and valve sizes to handle the additional volume recirculated from the press cylinder. With valve costs almost tripling when the size is changed from $\frac{3}{4}$ to $1\frac{1}{4}$ inch, the price of a differential circuit can be high. In return for this extra investment the user gets greater speed.

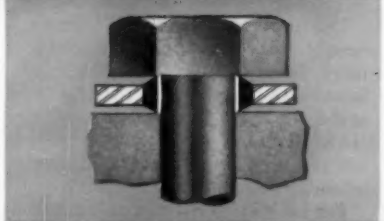
Rex Burnham describes a differential press circuit for tonnage ratings of 30 to 75 tons which does not require increased valve sizes. The circuit on page 95 shows how it's done.

Precision Dyna-seals...

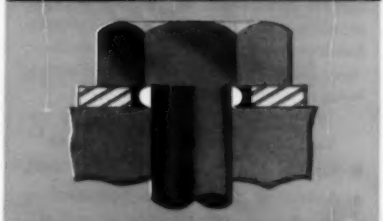
provided leak proof vibration proof sealing for Cummins Engine



Here's how Dyna-seal works.



Dyna-seal before bolt head is drawn down. Note flare of sealing member.



Bolt head drawn down. Lock washer action. Bolting torque reduced.

In the Cummins Engine fuel system, a filter screen in the pressure regulator is a vital element. This filter must be readily accessible for occasional cleaning, yet perfect operation requires vibration proof and leak proof sealing of the filter chamber to avoid loss of power. Dyna-seal filled those sealing requirements.

Dyna-seals bring to an end the face-to-face sealing problems of many other manufacturers in automotive, mining, industrial and marine fields. This practical one-piece unit, consisting of a flared rubber sealing ring, heat and pressure bonded to a steel washer provides a positive seal against pressure of up to 10,000 P.S.I. It eliminates grooves and special machining – reduces tooling – cuts assembly costs – may be re-used.

Dyna-seals give exacting performance under bolt and rivet heads, cap nuts, flanges or special fittings. Let a Precision engineer demonstrate the many Dyna-seal cost and labor-saving advantages to you. Write today!

Write for your free copies of Precision catalogs on "O" Rings and Dyna-seals

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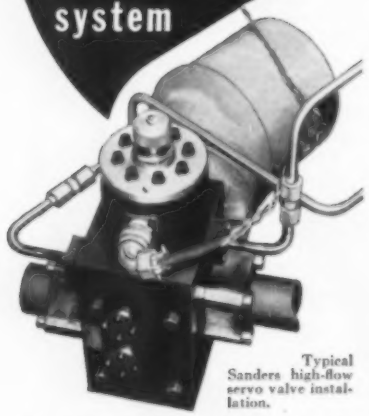
Reliability for the heart of your electro-hydraulic servo control system



Typical Sanders high-flow servo valve installation.

In the development of automatic control systems involving position, velocity or force, Sanders Associates maintains a completely equipped electro-mechanical and hydraulic laboratory devoted to systems engineering.

The hearts of these systems are the various Boot-Strap* electro-hydraulic servo valves designed and built by Sanders. From the largest (0-400 GPM) to the smallest (0-1 GPM), these valves can be integrated into any complete system requiring high frequency response, reliability and simplified operation.

For both industrial and military application, Sanders electro-hydraulic control systems have a record for reliable performance under extreme environmental conditions. If you are seeking maximum efficiency for similar systems, Sanders engineers are glad to contribute their experience to your needs. Simply write to Dept. AH-11.

Vital control functions performed by Sanders Electro-Hydraulic Servo Valves

- Aircraft and missile control systems.
- Atomic-powered submarine steering and diving systems.
- Anti-aircraft gun systems.
- Aircraft test facility systems.
- Rocket and jet engine fuel control systems.
- Widely varied process control systems.

*T. M. Sanders Associates

SANDERS ASSOCIATES INCORPORATED
NASHUA, NEW HAMPSHIRE

Fluid Power Lines

continued

INCH CONTROL . . . When we called on Micromatic Hone, we talked about surface finish with R. C. Engle, who has authored the article on the honing circuit in this issue. The Microhoning process generates accurate size and surface by having controlled motion and pressure. Air counterbalancing and hydraulic reciprocation are used in the design of this honing equipment.

DIP-N-RINSE . . . is the cycle of an automatic machine for processing porcelain, developed at Pass & Seymour. Accomplishing the necessary movements and timed sequences became a project in pneumatic and electrical circuit design. Paul Winter describes the work starting on page 84.

AUTOMATION IN THE SOUTH . . . One of the many applications of pneumatics to the textile industry is described in an article by J. B. Patterson. It's an interesting part handling set-up.

1955 PRIZE WINNER . . . Our aviation article this month won a cash award in the 1955 Prize Paper Contest. If you are planning to enter the 1957 contest, this article suggests one area of interest—testing procedures. For more information about the 1957 contest see page 24.

THINKING HANDS . . . A history of machine design would show that early efforts were directed toward equipment which would do brute force operations which are beyond the strength of man, of horses, and even elephants. These hard working machines were designed to be properly guided by man. Today, design effort is aimed toward taking the "guiding" or control function out of the hands of a man and putting it into the machine. The dream of the robot man is not new; however, the idea of a mechanical man is perhaps outdated.

Take a look at the article describing Barber-Colman's automated gear hobber starting page 73. That's what got us off on the mechanical—oops—in this case pneumatic man kick.

NEXT MONTH . . . December AH is the Fluid Power Mobile Equipment issue. Articles will emphasize present and future applications of positive displacement pumps and motors for driving the travel motion of construction, agriculture, coal mining, railway maintenance and material handling equipment.

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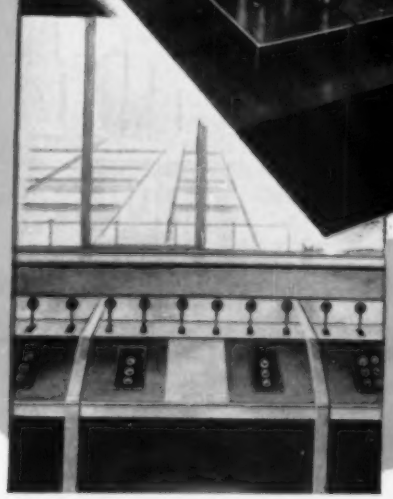
Inlet Penstocks in raised position

View of the 3 'VSG' Pumping Sets



View from control house overlooking inlet penstocks: control desk in foreground

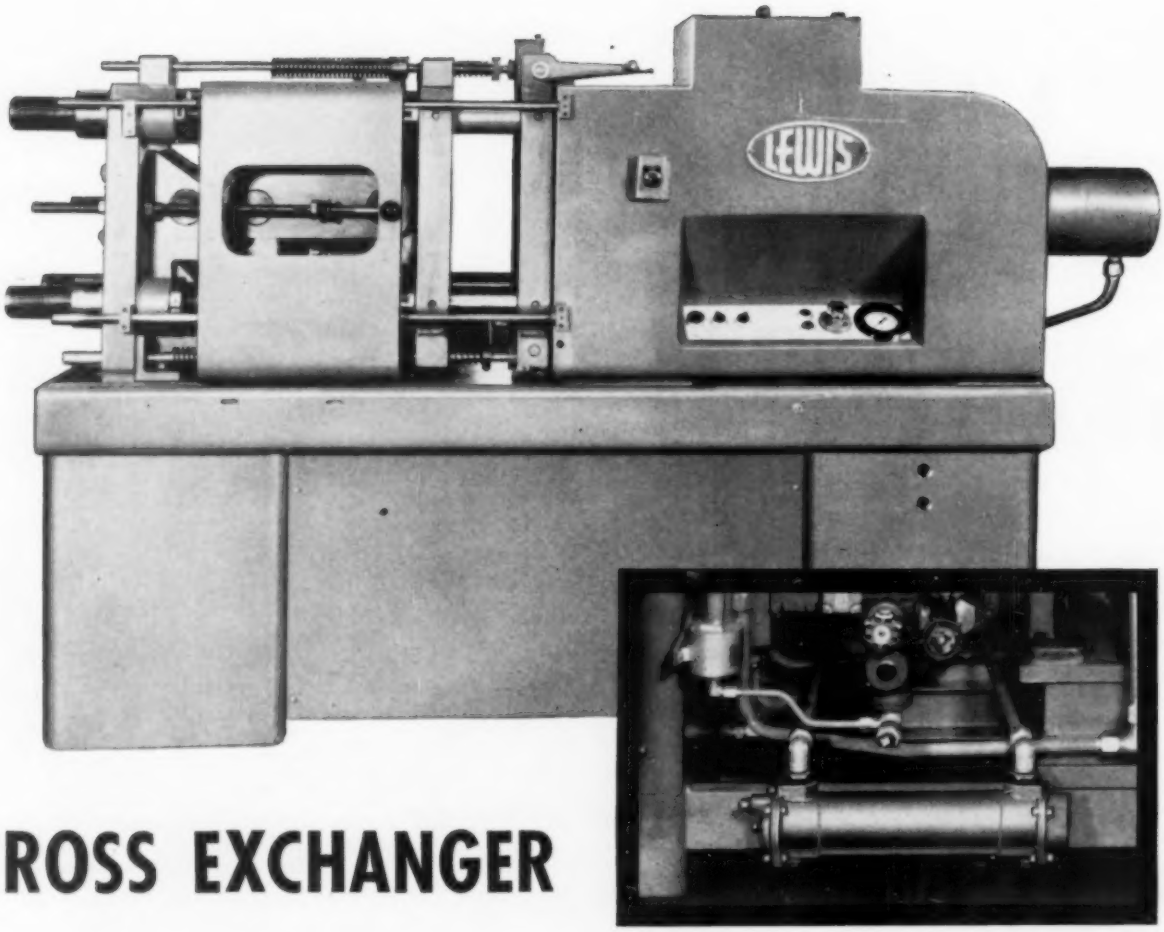
L.C.C. Northern Outfall Detritus Pits Scheme

This scheme handles 200 million gallons of sewage per day. The layout consists of six Detritus Pits each having an inlet and outlet channel with the flow controlled by hydraulically operated penstocks. The pumping equipment consists of 'VSG' hydraulic auto pumps, storage tanks, control valves and operating desks. 'Holding' pressure on ram can be maintained over long periods and a source of high pressure oil is constantly available. Each penstock is desk operated by valves for raising, lowering and suspending. These three operations can also be carried out by hand at penstocks.

VICKERS-ARMSTRONGS (ENGINEERS) LTD.

VICKERS HOUSE · BROADWAY · LONDON · ENGLAND Cables: Vickerseng, London Telex

East: Consolidated Engines & Machinery Co., Ltd., 5645, Pare, Montreal, Quebec. **West:** Galbraith & Sulley Ltd., 1331 W. 6th Ave., Vancouver 9



ROSS EXCHANGER

cools oil to keep pressures at peak level in Lewis plastic molder

Exerting a mold clamping pressure of 110 tons, this Lewis Model 412-D-8 Plastic Injection Molding Machine is designed to apply a maximum injection pressure of 21,200 psi on the material.

Neatly mounted next to the power unit, a Ross Type BCF Exchanger insures these rated pressures by providing safe, dependable oil cooling at all times. Oil viscosity can not drop to impair pump efficiency.

Ruggedly built to withstand punishing hydraulic shock, Ross Exchangers are featured accessories on die casters, metal drawing presses, plastic molders, extrusion presses, fluid drives, welders, stretch wrap formers and many other types of prime equipment.

Compact, easy to install and easy to maintain, Ross Exchangers are unrivaled in thermal efficiency. Completely pre-engineered and fully standardized, they're available in a wide range of sizes to answer your needs without expensive "specials" in either design or fabrication.

For detailed information, request Bulletin 1.1K5. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS

ROSS HEAT EXCHANGER PRODUCTS

NEW...Webster Directional Control Valves

ECONOMICALLY PRICED SINGLE SPOOL AND MULTI-SECTIONAL VALVES

These new WEBSTER single spool units and multi-sectional (series type) Directional Control Valves are designed to control and direct the flow of oil to cylinders and hydraulic motors in agricultural machinery, road-building equipment, machine tools, and a variety of other applications. They combine a very economical price with outstanding performance features including:

- **Built-in relief valves with *poppets of molded nylon* for minimum leakage . . . convenient screw adjustment**
- **Valve spool hard chrome plated and ground after plating for low internal leakage and long life**
- **May be furnished with detent pressure return feature which automatically shifts valve spools from "ON" to Neutral when cylinder being operated reaches end of stroke, or exceeds preset pressure**
- **Variety of mounting brackets, tapped mounting holes, to accommodate almost any mounting situation**
- **Inlet port provided on single spool valves on either right or left side of valve body**
- **Control handles on single spool valves can be installed in any of four positions, 90° apart**
- **Choice of spools for 4-way or 3-way operation, open or closed center**

These valves are designed for operating pressures up to 2000 psi, shock pressures to 5000 psi. They have a capacity of up to 20 gpm with a minimum of back pressure. All ports have ¾" pipe thread. Available with relief valves, normally set at 1000 psi which can be adjusted from 500 psi to 1500 psi. Single spool unit valves can be connected in series to operate two or more cylinders, independently or together. Multi-sectional valves are available up to six spools.

Write Today for Complete Information

Please forward complete information, including dimensional drawings and back pressure curves on

- ☐ Single spool unit valve
- ☐ Multi-sectional (series type valve)
- ☐ Please send catalog on hydraulic pumps and motors (up to 30 gpm)

Name_____

Title_____

Company_____

Street_____

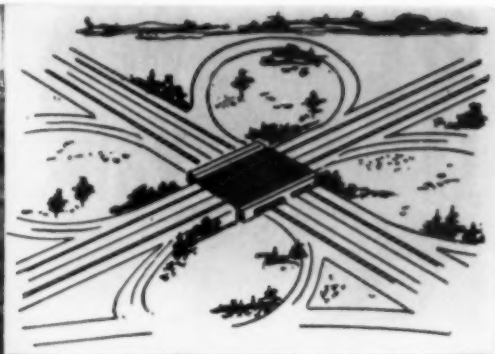
City, Zone & State_____

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

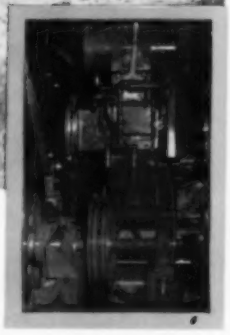
RACINE • WISCONSIN

MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY



GALION 104 Motor Grader, above, uses Eastman Assemblies on *EIGHT* Hydraulic controls for more accurate, effortless and economical grading. Close-up, left, shows powerful Hydraulic Circle Turn for famous Galion "Reversible" Moldboard.

BARBER-GREENE Bituminous Finisher, right, automatically lays level finish for smoother, safer travel. Close-up shows Eastman Hydraulic Hose Assembly delivering 2,700 lbs. pressure to raise and lower finishing screed.



Smoother, Safer Roads

BUILT WITH HYDRAULIC POWER

DELIVERED THROUGH

Eastman

HYDRAULIC HOSE ASSEMBLIES

ALWAYS SPECIFY

EASTMAN Pressed-on, Reusable and Renewable Couplings for high and low pressure air, gas, water, paint, grease and hydraulic fluids. Eastman Straight and Angled Adapter Unions.

Smoother, safer highways are being built today through the application of modern engineering and the use of modern equipment—much of which is hydraulically operated—using Eastman Hydraulic Hose Assemblies.

GALION—pioneer builder of road machinery—whose Motor Graders and Rollers are used 'round the world—first used hydraulic controls as early as 1927. Eastman Mfg. Co. pioneered in the development of Hydraulic Hose Assemblies in 1926—and *Galion is Eastman equipped today!*

BARBER-GREENE—whose Bituminous Road Finishers have been used at one time or another on almost every road ever built—also uses Eastman Hydraulic Hose Assemblies. Hydraulic power is used to raise and lower the all-important mechanism which lays a level finish—regardless of irregularities in the base. Barber-Greene's founding date of 1916 closely parallels Eastman's of 1914—and *Barber-Greene is Eastman equipped today!*

EASTMAN—*first in the field*—is proud to have pioneers such as Galion and Barber-Greene—as well as many other leading American manufacturers—use Eastman Hydraulic Hose Assemblies. Look to Eastman for *continued leadership* in engineering and design for quality of material and workmanship—plus better-than-ever service through expanded production facilities of our new, modern plant.

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

Eastman

first in the field

MANUFACTURING COMPANY

Dept. AH-11, Manitowoc, Wis.

WRITE for Eastman Catalog or send blueprints stating your hydraulic requirements and specifications.

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS Magazine, 812 Huron Rd., Cleveland 15, Ohio.

Impulse Test Equipment

I am interested in impulse testing equipment, specifically that used to test hose assemblies to Mil-H-5511 and Mil-H-5512 specifications.

Can you send me information concerning the design and operation of this equipment or leads where this information is available?

V. L. VAILLANCOURT
Development Engineer
The Polymer Corporation
Reading, Pa.

To help with this design problem, we've sent names of users of impulse test equipment as well as manufacturers.

Pressure Switch

Please tell us where to purchase plunger pressure switch shown on page 57 AH August issue. Rating desired—300 psi, 220 v, 15 watts.

GEORGE JOSEPH
Central Engineering
Food Machinery & Chemical Corp.
San Jose, Calif

Vickers Inc. is the manufacturer of this switch. It has a pressure range of 100 *to* 2000 *psi with an electrical rating of* 5 *amperes at* 200 *to* 250 *volts.*

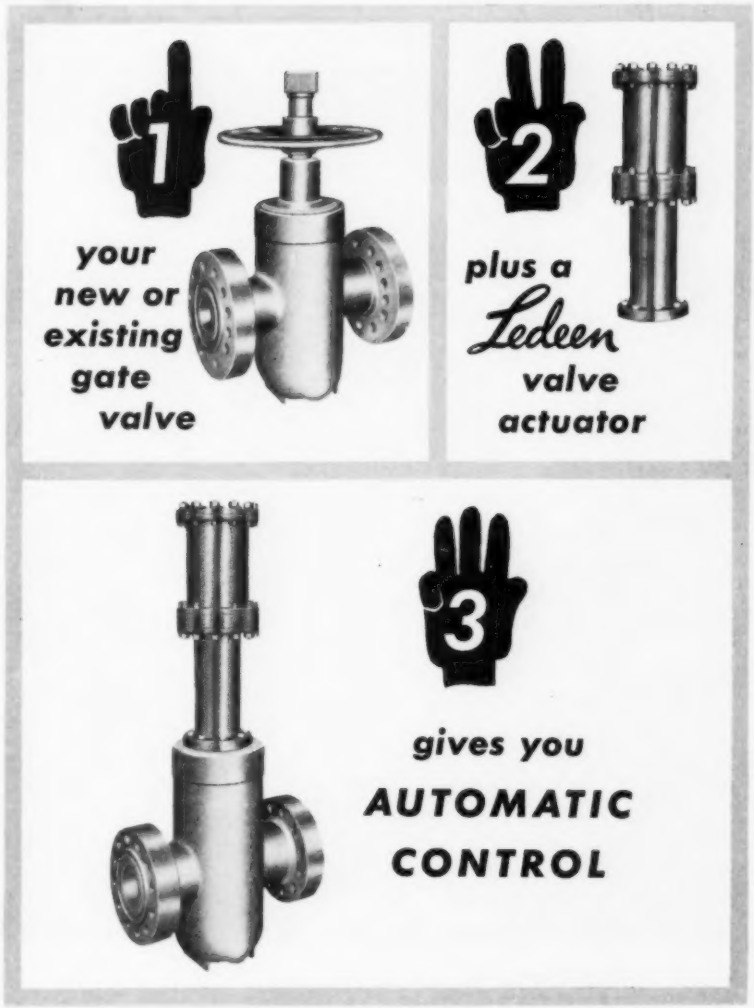
Pump Manufacturers

Please send me a complete list of manufacturers of hydraulic pumps and variable displacement pumps.

J. T. ALOISIO
Special Equipment Manager
Raytheon Manufacturing Company
Waltham, Mass.

Copy of the complete list as published in the MASTER CATALOG *of Fluid Power Products has been sent.*

Continued on page 16

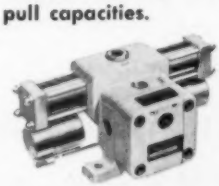


SIMPLE AS 1 2 3

Without interruption of service, and with only slight modification, every rising stem gate valve in your line can be converted to automatic control by the simple and easy process of installing Ledeen Valve Actuators.

Pneumatically or hydraulically operated, these valve actuators are adaptable to gate, diaphragm and plug valves for direct or remote control.

Ledeen Valve Actuators are available in a wide range of stem pull capacities.



Control your Ledeen Actuators with Ledeen Valves

Write for Bulletin 3030

VALVES • CYLINDERS
VALVE ACTUATORS
AIR-HYDRAULIC PUMPS
AND BOOSTERS

Ledeen Mfg. Co.
3332 North Gilman Road
El Monte, California

Circle 83 on Reader Service Card

Is this Garter Spring necessary on your Oil Seal application?

The answer lies in an individual *evaluation of your application.* Garter springs, where not required, can take a "free ride" at your expense. The mechanical action created by garter springs can result in excessive torque and friction . . . can often shorten seal life . . . can actually cause shaft wear.

IPC seals are designed, compounded and bonded to provide inherent resistance to operational stress, *often without the added cost of mechanical "pinch".*

If excessive eccentricity, temperature range or other conditions do warrant the use of mechanical "pinch", IPC engineers will design your oil seal to combine custom compounding with minimum spring "pinch" consistent with good performance.

Before you buy, ask for IPC's recommendation.

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

PACKINGS • OIL SEALS • PRECISION MOLDING

BONDED BY IPC

1. Bonded Washer Seal Double Lip Wiper
2. Bonded Case Seal Double Lip Wiper
3. Bonded Washer Seal Straight Lip
4. Bonded Washer Seal Limited Contact Lip
5. Bonded Washer Seal Straight Lip With Garter Spring
6. Bonded Washer Seal Limited Contact Lip With Garter Spring
7. Bonded Case Seal Straight Lip
8. Bonded Case Seal Limited Contact Lip
9. Bonded Case Seal Straight Lip With Garter Spring
10. Bonded Case Seal Limited Contact Lip With Garter Spring
11. Bonded Case Seal Straight Lip Thin Rind Type
12. Bonded Case Seal Limited Contact Lip Thin Rind Type
13. Rubber Covered Bonded Case Seal Straight Lip
14. Rubber Covered Bonded Case Seal Limited Contact Lip
15. Rubber Covered Bonded Case Seal Straight Lip With Garter Spring
16. Rubber Covered Bonded Case Seal Limited Contact Lip With Garter Spring

P6

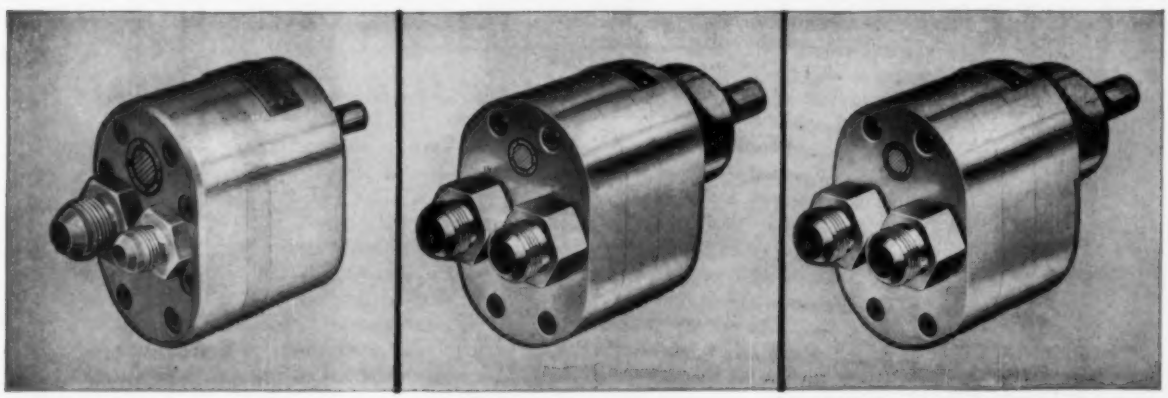
specify with confidence...

HYDRAULIC PUMPS FLUID MOTORS

Design engineers have confidence when they specify dependable Eastern Hydraulic Pumps and Fluid Motors. Exclusive Eastern features create an economical, reliable, and compact unit for the heart of your hydraulic mechanism.

Lightweight construction of aluminum alloy housing, nitralloy gears and shaft, and close tolerances assure longer service, higher volumetric efficiency, and more dependable operation. Various types of mountings are available for space saving installation.

In many cases by specifying an Eastern unit you realize dollar savings as well as great savings in size. They cut operating costs by keeping space requirements and weight to a minimum.



100 Series — Heavy duty gear pump. Delivery from .1 to 5 gpm and working pressures up to 1,500

700 Series — High pressure gear pump. Delivery from .6 to 9.6 gpm and pressures up to 1,500 psi.

2700 Series — Gear type fluid motor. Torque output — 0 to 15 ft. pounds.

Send for Eastern Hydraulic Catalog F-800. Contains valuable engineering diagrams and information.

Eastern INDUSTRIES, INC.

100 SKIFF ST., HAMDEN 14, CONN.

Circle 42 on Reader Service Card

Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.

HILCO
OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

WRITE TODAY FOR THIS *Free* BOOKLET

Recommendations at no Obligation

THE HILLIARD *Corporation*

148 W. FOURTH ST. • ELMIRA, NEW YORK

IN CANADA: [illegible]

LETTERS to the editor

Designer's Checklist

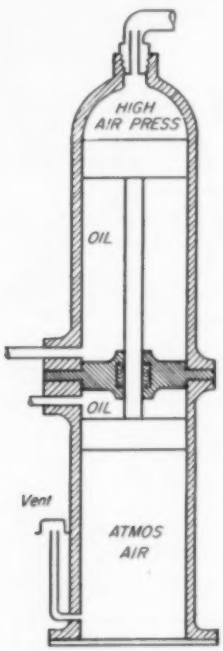
Can I get a reprint of the article, "Hydraulic Designer's Checklist" which appeared in the June issue of APPLIED HYDRAULICS?

ERNST A. KREMEYER
Whirlpool-Seeger Corporation
St. Joseph, Michigan

Tearsheets have been sent.

Self-Displacing Accumulator

The so-called self-displacing accumulator described in the August issue was used by the writer nearly nine years ago, in the development of a power circuit for a U.S. Navy transfer-at-sea cargo winch.



This winch was produced by the C. H. Wheeler manufacturing Company, with Mr. J. C. Patterson acting as their consulting engineer.

The winch was successfully used and demonstrated on shipboard, as a prototype in 1950, and more were contracted.

In this case, the accumulator, at the same time that it stored energy, supplied supercharging

Continued on page 18

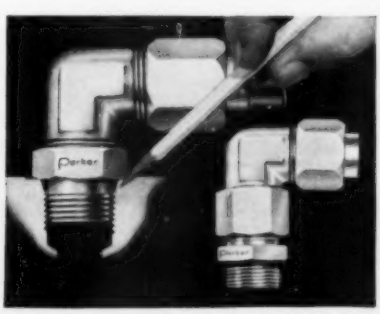
Be sure to see Parker for both tube and hose fittings!

Here, from one convenient source, you can get the most advanced hydraulic fittings available . . . both tube *and* hose. For example, new Parker *no-skive* Hoze-lok fittings require no stripping of rubber-covered hydraulic hose. They're faster, easier to use and *re-usable.*

Also, new Parker *straight-thread* tube fittings solve high-pressure hydraulic leakage problems resulting from tapered pipe threads. *Straight* threads are available on Triple-lok (the industrial standard flare tube fitting) and on Ferulok (flareless fitting for heavy steel tubing).

Parker
Hydraulic and fluid system components

***No-skive* Hoze-lok fittings** need no stripping of hose covers. Only two simple steps complete the make-up. Re-usable.



Straight-thread tube fittings provide leakproof, trouble-free connections. No overtightening. O-ring makes the seal.

TUBE & HOSE FITTINGS DIVISION
Section 422-A
The Parker Appliance Co.
17325 Euclid Ave., Cleveland 12, Ohio

☐ Please send *no-skive* Hoze-lok Bulletin No. 4402
☐ Straight-thread fittings Catalog No. 4301

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

EAGLE

time delay relay

for transmitters and other industrial or aircraft applications

Compactness . . . plus **"Mil-Spec"** precision

A complete timer, weighs only 9 ounces. Yet it passes rigid military tests for accuracy, vibration, shock, salt spray, humidity. Developed for radio and radar transmitters, now available for any application that requires this precision, space-saving timer.

As one example, this new timer (HYS series) gets electronic equipment back into service just as quickly as warm tubes reheat to safe operating temperatures. Starts operation *minutes sooner* when tubes have not completely cooled from a previous operation. It's safe. Cuts lost operating time. Standard 28V D. C. Other D. C. ranges on request. Units may be operated from 115V A. C. rectified source. Free bulletin.

EAGLE SIGNAL CORPORATION
Industrial Timers Division
MOLINE, ILLINOIS

------MAIL COUPON TODAY-------

Eagle Signal Corporation, Dept. AH-1156
Industrial Timers Division
Moline, Illinois

Please send Bulletin 820 with operation data and specifications on the new HYS series time delay relay.

NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

LETTERS to the editor

pressure to the large hydraulic motor, acting as a pump, while the line was being pulled out; as well as accepting storage oil while the stored energy was used to retrieve the high-line.

This accumulator was quite large, having a stroke of 14 inches and a bore of 18 inches. Our original sketch made in 1947 shows identical principle for the double-acting accumulator.

R. B. GALLOWAY
Vickers Incorporated
Washington, D. C. Office

This application of a double acting accumulator should interest many readers. The article in August described much smaller accumulators designed for aircraft applications.

Dump Truck Cylinders

Please send a list of manufacturers who make hydraulic cylinders mounted on a subframe suitable for dump trucks. Of particular interest are manufacturers that produce a unit comparable to twin cylinder Daybrook Hoist 44 DIA.

LEWIS R. GOODMAN
Commercial Waste Service
Miami, Florida

We have sent a complete list of companies making hydraulic cylinders for dump truck applications.

Rubber Molded Product

We are looking for a Neoprene rubber guard. We need fifty having an inside diameter of 2-3/16 in and anywhere from ½ to ¾ inch thick; and 25 of the same thickness but with an inside diameter of 1-⅞ inch. Inside diameter is critical; o.d. to be 1 inch larger than i.d. Shoulders need not be square.

C. W. WIEDMANN
E. I. DuPont de Nemours
Fort Madison, Iowa

A list of rubber molded products manufacturers has been sent.

▼▼▼

the ALL-AROUND VERSATILITY

PLUS values in power

of the HOWELL series one hundred motor line gives you A WIDE RANGE OF MOUNTINGS AND ELECTRICAL CHARACTERISTICS TO FILL YOUR PARTICULAR MOTOR NEEDS

TOTALLY ENCLOSED FAN-COOLED

OPEN DRIP-PROOF

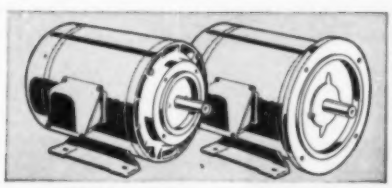
To meet your job requirements exactly, the new Howell Series 100 motors are available in each of the five standard constructions illustrated here. And under their streamlined good looks lie a wealth of "plus values" in construction that make these rerated motors your best buy for long range dependability.

Beyond mountings, there's a broad range of electrical types and mechanical combinations that are accommodated readily by the basic Series 100 design. A partial list is as follows:

Normal torque	*Single phase*
High torque, compressor duty	*Torque motors*
Punch press, elevator and crane hoist	*Brake motors*
Multi-speed	*Part Winding*
Reluctance synchronous	*Rapid reversing*
	Special application
	Gear motors

SPLASH-PROOF and WEATHER-PROTECTED

TOTALLY ENCLOSED NON-VENTILATED



C-FACE D-FLANGE P-BASE

EXPLOSION-PROOF (available soon)

For more details on Series 100 motors, write for Bulletin N-100-R

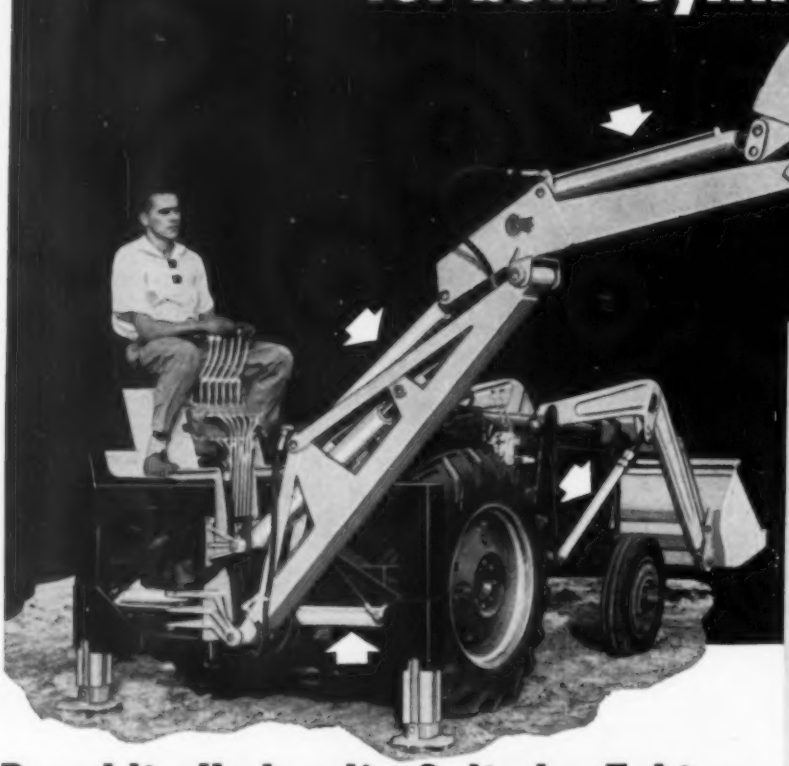
HOWELL Red Band MOTORS

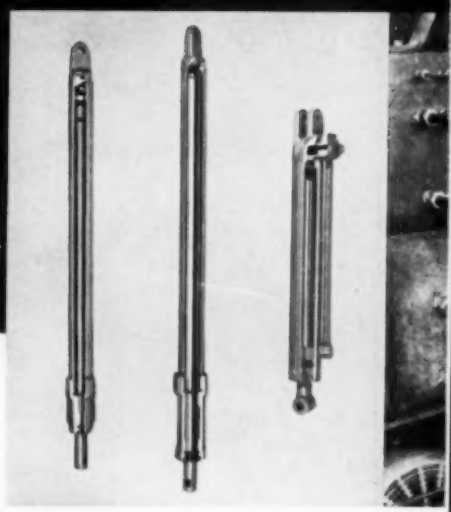
HOWELL MOTORS

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

NOW...Republic ELECTRUNITE steel for both cylinder and line





Republic Hydraulic Cylinder Tubing

The powerful Davis Back-Hoe, a product of Mid-Western Industries, Wichita, Kansas, thrives on rugged jobs where sheer power and dependable performance are musts.

To get both, a considerable amount of Republic ELECTRUNITE® Hydraulic Cylinder Tubing is used in the cylinder assemblies. The Industrial Hydraulics Division of Cessna Aircraft Company, Hutchinson, Kansas, fabricators of these cylinders, has found that this high-quality tubing is ideal to work with for several important reasons.

They like the easy honing characteristics, the ability of the raw tube to clean up and provide a defect-free surface, to the required micro-inch finish. They like the uniform roundness, concentricity and ductility in every inch of tubing. In fact, it's these predictable physical characteristics of Republic ELECTRUNITE Hydraulic Cylinder Tubing that enable manufacturers to establish efficient production procedures.

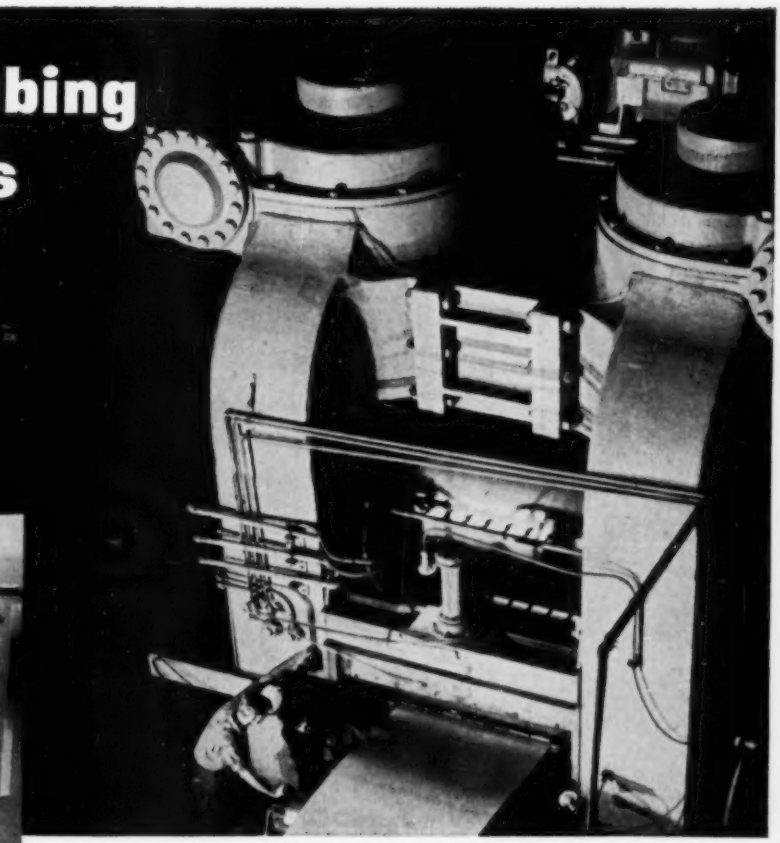
It will pay you to get all the facts on Republic ELECTRUNITE Hydraulic Cylinder Tubing. You'll discover that a substantial saving is possible on processing costs. Tubing is available in a wide range of sizes and wall thicknesses regularly used in hydraulic cylinder applications.

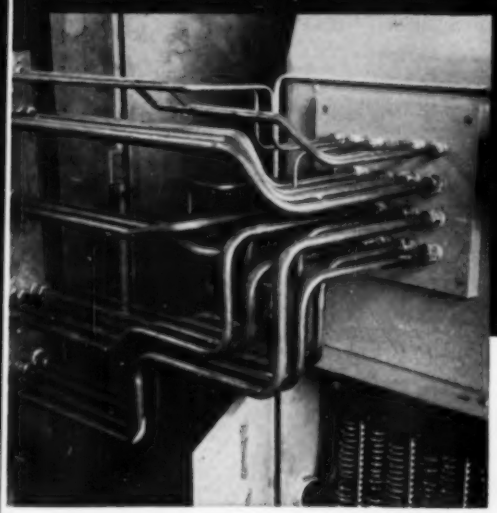
REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

hydraulic tubing applications





Republic Hydraulic Line Tubing

Republic produces an electric welded steel hydraulic line tubing to a highly restrictive specification that will assure unsurpassed performance in your high-pressure applications.

This specification is the result of knowledge gained in the manufacture of critical ammunition components used in Korea. The excellent performance of our welded tubing throughout this period proved beyond a doubt its complete dependability.

In addition to serviceability, Republic ELECTRUNITE Hydraulic Line Tubing includes other important advantages. Because the tube is formed from flat rolled steel, both inside and outside surfaces can be checked for defects. The resulting uniform wall of the tube coupled with high ductility provides excellent flaring and bending characteristics. And the tube is not subject to longitudinal and transverse cracks.

It will pay you to get *all* the facts on Republic ELECTRUNITE Hydraulic Line Tubing. You'll discover how it can substantially reduce maintenance costs in complicated installations. It's available in a wide range of sizes and in wall thicknesses regularly used in hydraulic applications. Fits all standard fittings and accessories. Send coupon for additional information.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
Dept. C-2760
211 East 131st Street, Cleveland 8, Ohio

I would like a sales representative to call with additional information on Republic:

☐ ELECTRUNITE Cylinder Tubing
☐ ELECTRUNITE Line Tubing

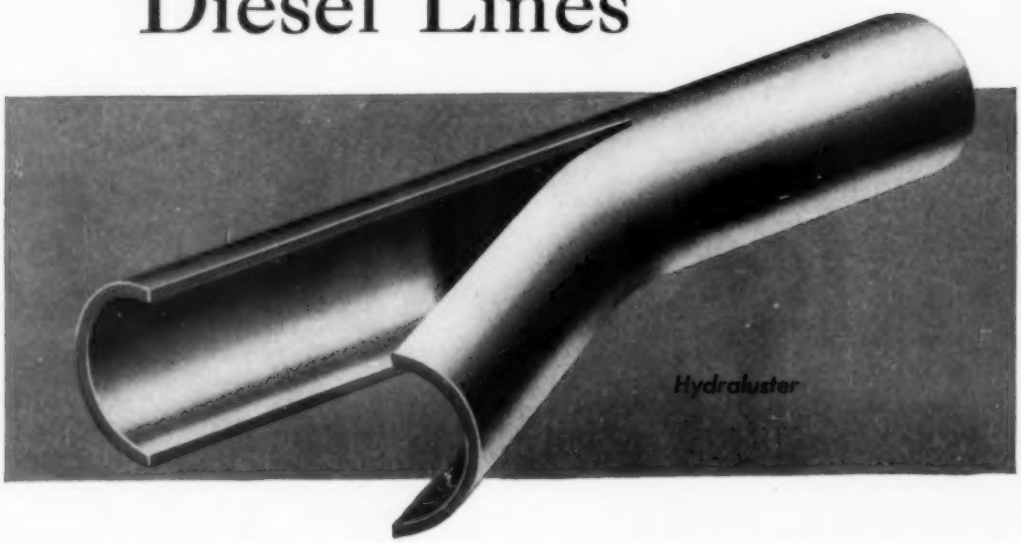
Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

A New Material for Hydraulic and Diesel Lines



T. L. PARKER Vice President
Columbia Steel and Shafting Co.

Interior scaling and flow resistance—magnified by the introduction of the newer, high speed hydraulic fluids—point up a problem that is not entirely new to designers and engineers in the hydraulic and diesel fields. Oxidation and scale adhering to tubing walls can restrict flow in fluid systems, causing pressure changes and forcing the system to function at a substandard rate of efficiency. This same scale, loose and circulating, of course causes additional damage and premature deterioration of valves and pumps. The introduction of any other type of foreign matter or dirt, during or after manufacture, would have the same general effect.

A new tubing, now available in commercial quantities, is providing a logical solution to the problem. Marketed under the name of Summerill HYDRALUSTER, it has an exceptionally smooth, bright and *clean surface on both interior and exterior walls.* Produced by an annealing process that regulates the cooling cycle as meticulously as the heating phase, Hydraluster is highly resistant to oxidation, and the smooth wall finish is not conducive to dirt adherence. Initially clean, the tubing is shipped fully protected by special preservatives, and it can be provided in individually capped lengths. The preservatives are easily removed with good grades of commercial solvent.

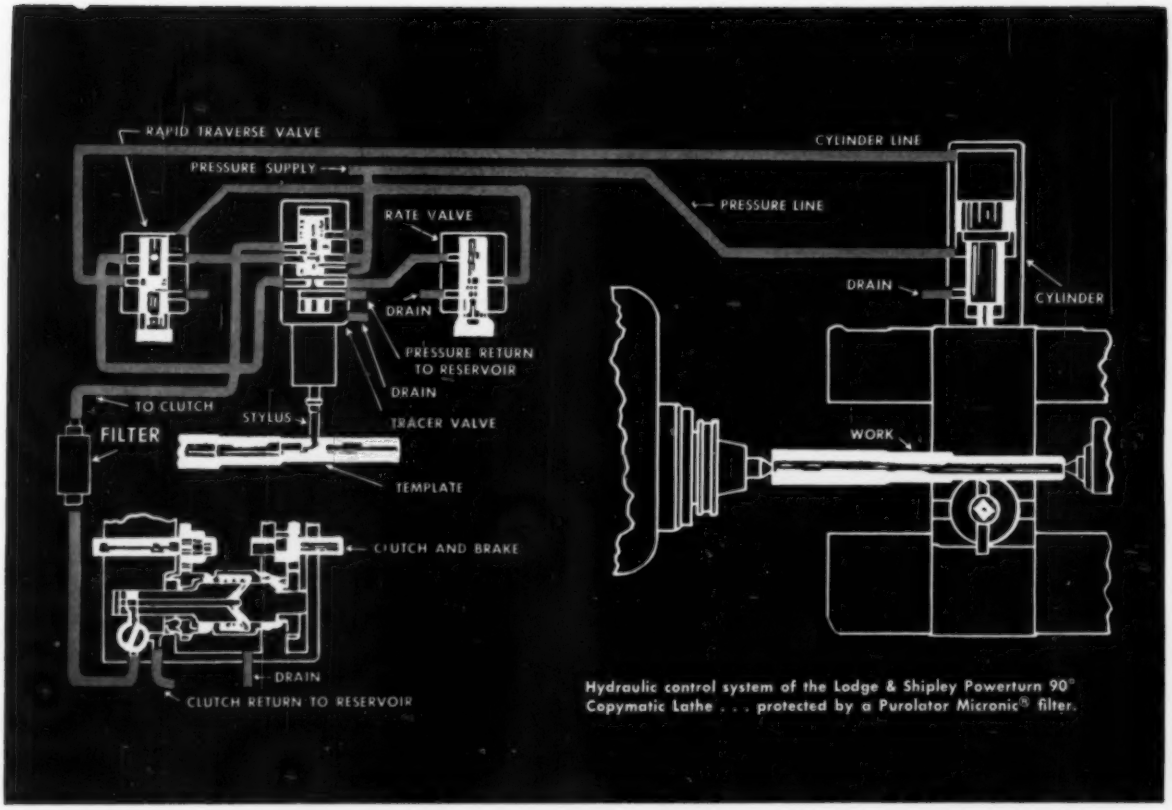
An interesting by-product of the silver-bright finish is the sales appeal it adds to OEM equipment. Hydraluster has the inherent strength and exceptionally fine working properties of steel, and is available at standard hydraulic tubing prices.

SAMPLES and SPECIFICATIONS: While supplies last, we'll gladly send you a sample of HYDRALUSTER. Your name, on company stationery, will bring specifications, descriptive literature and the sample by return mail.

Summerill **Tubing Company Division-Columbia Steel & Shafting Co.**

PITTSBURGH 30, PA. DEPT. NO. 10-10

District Offices: Buffalo • Chattanooga • Cleveland • Dayton • Hartford • Philadelphia • Pittsburgh • Milwaukee • Chicago



Hydraulic control system of the Lodge & Shipley Powerturn 90° Copymatic Lathe . . . protected by a Purolator Micronic® filter.

Designed for highly accurate control ...fully protected by Purolator Filtration

On a very successful automatic duplicating lathe, this hydraulic control system makes possible both quick, simple operation and a high degree of sensitivity and accuracy. Reliable and uninterrupted operation of a system like this is dependent upon freedom from contaminants. That's why the Lodge and Shipley Company, its manufacturer, made Purolator Micronic® filters an integral part of their hydraulic system.

Purolator engineers recommended a standard filter from their stock of over 2000 models. It more than met the system's special requirements.

The controlled porosity of Purolator's Micronic element evenly filters out contaminant particles as small as .000039 inch. And because it's made of plastic-impregnated cellulose, the Micronic element is not affected by high temperatures, water, or oil.

FILTRATION FOR EVERY KNOWN FLUID

PUROLATOR

PRODUCTS, INC.

Rahway, New Jersey and Toronto, Ontario, Canada

Filtering information for product designers is available in our 32 page "Filtration Manual for Product Designers". Just enclose 25¢ to cover postage and handling. Address Dept. PS-1126

BRIEFS about fluid power

JUDGES FOR 1957 PRIZE PAPER CONTEST

Three outstanding engineers, who for many years have been engaged in the advancement of fluid power in the machine tool, fabricating machinery and mobile equipment fields, have accepted the invitation to serve as judges for the 5th Annual APPLIED HYDRAULICS Prize Paper Contest.

EARNEST Y. SEBORG

B. I. ULINSKI

A. J. DE MATTEO

• *Earnest Y. Seborg*—Head of Development and Experimental Department, Ingersoll Milling Machine Company, is a veteran in the fluid power field. From 1934 to 1938 Seborg was in charge of hydraulic and electrical design for Ingersoll Milling. In 1938 he joined Barnes Drill Co. in the same capacity and from 1948 had been their assistant chief engineer, chief engineer and chief development engineer until he was named to his present position last July. Seborg, who has been very active in the promotion of fluid power, has authored many articles pertaining to hydraulics and hydraulically operated machines, and taught evening courses in hydraulics at the University of Illinois. A number of patents relating to hydraulic mechanisms have been issued in his name.

• *B. I. Ulinski*—Director of Product Research, Automatic Transportation Company, Division of the Yale & Towne Mfg. Co., has for many years been engaged in the design and development of hydraulic devices and applications for industrial trucks. Ulinski was appointed chief engineer of the company in 1932. Expanded engineering responsibilities made him director of engineering in 1952. He was instrumental in developing a line of control valves which enabled the control of the lifting and tilting motion of the fork truck mechanism either simultaneously or independently by means of a single control handle. He also supervised the development of powerful hydraulic steering mechanisms for use with giant multi-wheel trucks capable of handling 100,000 pounds or more. There are many other projects Ulinski has worked on and to which he is now devoting his time as director of the group to which he was assigned in September.

• *A. J. de Matteo*—Chief Engineer, Watson-Stillman Press Division, Farrel-Birmingham Company, Inc., joined the company in 1944, became assistant chief engineer in 1949 and was promoted to his present position in 1951. De Matteo has had wide experience in the hydraulic field. He was associated with Thomas & Betts Company from 1935—1940 and Mack Mfg. Co. from 1940—1944. He graduated with a degree in mechanical engineering from New York University in 1942. In 1953 he presented a paper about his

Continued on page 28

Check **THESE REASONS** ***and you'll see why you get better performance when you***

Specify **conpor**
controlled porosity Sirvis mechanical leather

LOWER TORQUE

Specially treated Sirvis-Conpor members available in C/R Oil Seals greatly reduce torsional drag, won't score shafts. They provide positive sealing over longer service life, are completely self-lubricating. Write for detailed information.

MINIMUM FRICTION

Want low sliding friction in hot, fast, high pressure applications? Sirvis-Conpor cups and packings can be custom-treated to your most exacting specifications. Won't chatter, score cylinders.

BETTER POROSITY CONTROL

The wide range of Conpor treatments . . . from practically unfilled to virtually non-porous leather permits packings with exact leakage and lubrication control, increased life. Stable in a wide variety of oils, gases, solvents.

SIRVIS C/R DIVISION

CHICAGO RAWHIDE

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1283 Elston Avenue • Chicago 22, Illinois
Offices in 56 principal cities. See your telephone book.
In Canada: Distributed by Chicago Rawhide Mfg. Co. of Canada, Ltd., Hamilton, Ontario
Export Sales: Geon International Corp., Great Neck, New York

OTHER C/R PRODUCTS

C/R Shaft & End Face Seals • Serveron (synthetic rubber) molded pliable parts • C/R Non-metallic Gears

The most important advance in tube fittings in 20 years!

New IMPERIAL HI-SEAL™

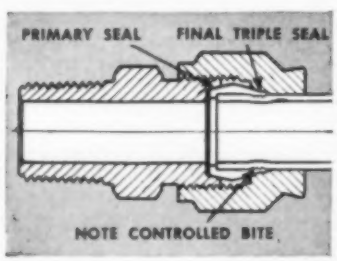
Furnished in steel and stainless steel

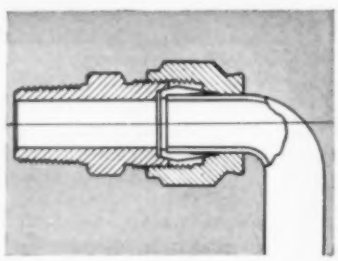
Successors to all other fittings for high-pressure, severe service

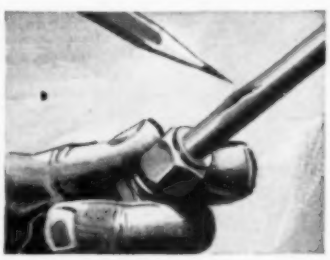
At last! A foolproof fitting that answers all the requirements of the "ideal tube fitting."

1. Positive butt-joints — no springing of tube.
2. Permits closer tube bends.
3. Eliminates tube torquing when making a joint.
4. Foolproof — Hi-Seal goes together only one way.
5. Assures repeated pressure-tight re-connections.
6. Joints stay pressure-tight beyond the burst pressure of tube — withstand severe vibration.
7. Threads are pitched for minimum torque in tightening — danger of stripping eliminated.
8. Far greater tolerance in tube length or placement during assembly.
9. Produced under continuous quality control methods to assure utmost reliability.

Big order? Sure — that's why the Hi-Seal is the most important advance in tube fittings in 20 years. Ask your Imperial distributor for complete information!







FOOLPROOF ASSEMBLY — There is only one way tubing can be inserted into sleeve, and only *one* way that the sleeve can go into fitting. Shoulder on sleeve prevents incorrect assembly. No need to disassemble joint to see if it has been properly made. Only an open-end wrench is needed for assembly.

CLOSER TUBE BENDS — Because of the extremely short tube entry and because no flaring is required, bends are made exceptionally close to the end of tubing. Hi-Seal fittings work in close quarters where other types of fittings cannot be used. Hi-Seal speeds assembly . . . drastically reduces field servicing time.

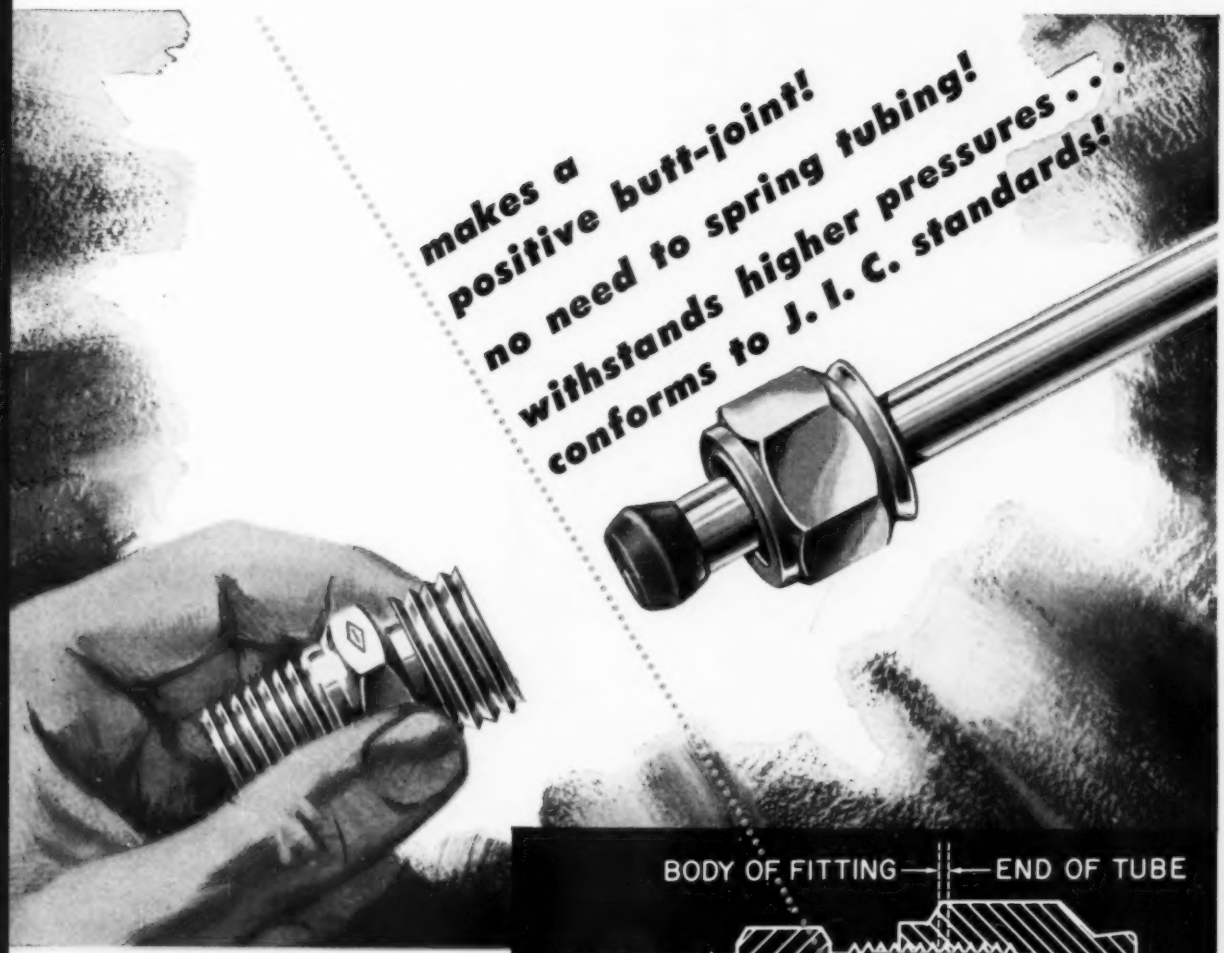
WITHSTANDS HIGHER PRESSURES — Joints made with Imperial Hi-Seal fittings stay pressure-tight beyond the burst strength of the tubing itself. Fitting is especially designed for hydraulic and other services where higher pressures are encountered. Can also be used in low and medium pressure applications as well.

Created and manufactured exclusively by . . .

IMPERIAL

THE IMPERIAL
1242 W. HARRISON STREET

Industry's most complete

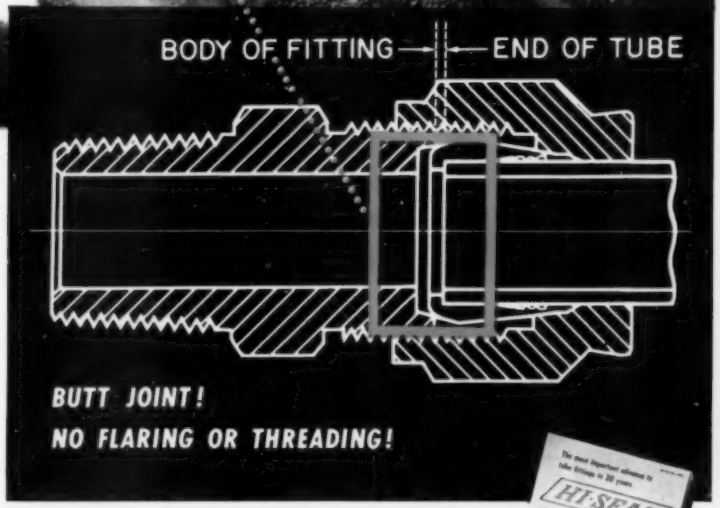


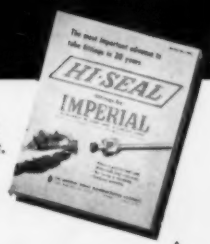
BUTT-JOINT FEATURE MAKES HI-SEAL EASIER TO INSTALL!

(a) Because Hi-Seal provides a positive butt-joint, and there is no tube entry into body of fitting, undesirable tube springing is eliminated. This is very important in the case of large-diameter, heavy-wall or hard-temper tubing where tube springing is extremely difficult and many times impossible.

(b) Note how tube "bottoms" on shoulder of sleeve (see diagram). Camming action of nut results in a controlled bite of sleeve into tubing. Serrated edges inside sleeve provide a triple, leak-proof seal. Finally, a perfect circumferential seal is made by tapered edge of sleeve in recess of body.

(c) Hi-Seal fittings are furnished complete with body, nut and sleeve assembled. Available with long Dryseal pipe threads or with straight threads with O-Ring seal.





***Just off the press** — highly informative bulletin No. 3061 on Hi-Seal principle and applications. Includes engineering recommendations, dimensional data, complete listing of types and sizes for ⅛" to 1½" O.D. tubing.*

BRASS MANUFACTURING COMPANY

CHICAGO 7, ILLINOIS *In Canada:* 334 Lauder Ave., Toronto, Ontario

Emblem of Quality

line of tube fittings and tubing tools

Lubrication
WITH A "SENSE" OF DIRECTION

How TUTHILL *Automatic Reversing Pumps* Protect Speed Reducers Regardless of Direction of Shaft Rotation

Photo courtesy Western Gear Corporation, Seattle, Washington

Reversing machinery like these autoclave drive units must be protected with positive lubrication regardless of the direction of shaft rotation. To insure this, Western Gear engineers required a lubrication pump that would reverse automatically whenever the drive shaft changed rotation. They selected the Tuthill Model R rotary, internal-gear, positive displacement pump for this application because of its exclusive automatic reversing feature. The Model R can be driven in either direction of rotation without changing the direction of oil flow or port positions, thus giving reversing equipment the most dependable lubrication protection possible.

In addition to standard pumps like these, Tuthill service includes the design, development and manufacture of special pumps to fit your individual needs. By taking advantage of Tuthill's custom engineering, you can avoid compromising the design of your product.

Write for Bulletin No. 105 on Tuthill Reversing Pumps or data on other types to fit your specific requirements.

TUTHILL PUMP COMPANY

See our Catalog in Sweet's Product Design File—6b-Tu

Dependable Rotary Pumps... since 1927

939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ontario, Canada

BRIEFS / continued

work on extrusion presses before the National Conference on Industrial Hydraulics.

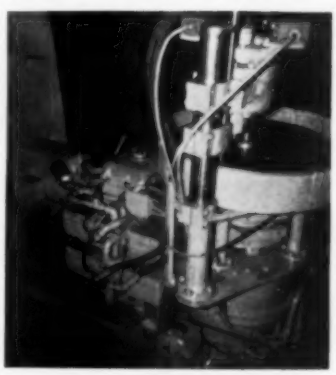
Anyone who uses, designs, builds or maintains fluid powered machines or equipment can enter this contest. All papers given cash awards and honorable mention will be published. ▼▼▼

For your copy of the 1957 Contest Rules Booklet Circle 340 on Reader Service Card.

Reciprocating Hydraulic Lapping Machine

Dual rotary, reciprocating motion of both lapping head and table are design features of this machine, which is now in operation in the Hydromotor Products Division of Ex-Cell-O Corporation.

The machine consists of a fabricated steel frame on which is

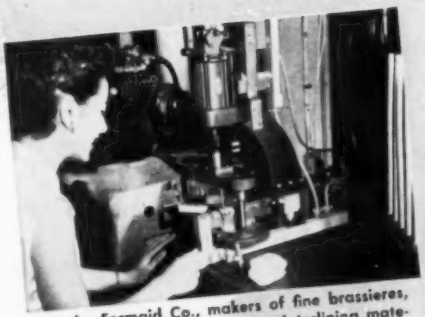


mounted a hydraulic power unit, with a 5 gpm pump. Rotation of the table on a 280 degree arc is accomplished by means of a 10-5 single-vane reciprocating actuator. The reciprocating motion is controlled by two limit switches and a solenoid-operated four-way valve. The lapping head consists of a 6-3 single-vane reciprocating actuator. Its stroke is controlled by a master cam, two limit switches and a solenoid-operated four-way valve. The lapping head sweeps over the full table area and a lead screw adjuster is provided for height adjustment. ▼▼▼

Continued on page 30

For an investment of less than $200. in Bellows Air Equipment—

LOOK WHAT HAPPENED!



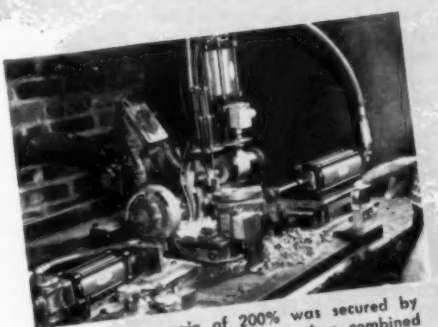
At the Formaid Co., makers of fine brassieres, Bellows Air Motors pre-crease interlining material, doing the job even better than a 5-ton punch press—with big reductions in spoilage, longer tool life, less set-up and much less down time.

Temple-Stuart Co., furniture manufacturers, teamed up two Bellows Air Motors and a Hydro-check for better than a 30% production gain in chucking wooden spindles, and as the operator put it—"at the end of eight hours I'm not tired at all."

Without heavy capital investment, substantial cost savings are being made in many operations with Bellows Air Motors and Bellows "packaged" work units: tool feeds, work feeders, holding devices.

These versatile units are being used to quickly convert standard machines to semi-automatic or automatic operation; or as basic components around which to build inexpensive special purpose machines.

More than 125 full-time Bellows Field Engineers (one or more in every major industrial area in the United States and Canada) are at your call to help your production men work out effective and low cost ways to use "Controlled-Air-Power."



A production gain of 200% was secured by Eastman Manufacturing when they combined three Bellows Air Motors in a special machine to mill and drill bakelite breaker arms. This set-up is one of 25 Bellows installations in the Eastman Plant.

Write today for these interesting free bulletins

Whatever you make, Bulletins ML-3 and BM-25 will make worth while reading for you and every member of your production staff. Address Dept. AH-1156

Drilling a fly wheel counterweight is being done at R. C. Phelon Co. three times as fast with a Bellows Drill Press Feed and Air Vise as it could be done by hand. And the unskilled operator works with minimum fatigue.

The Bellows Co.

AKRON 9, OHIO

In Canada:

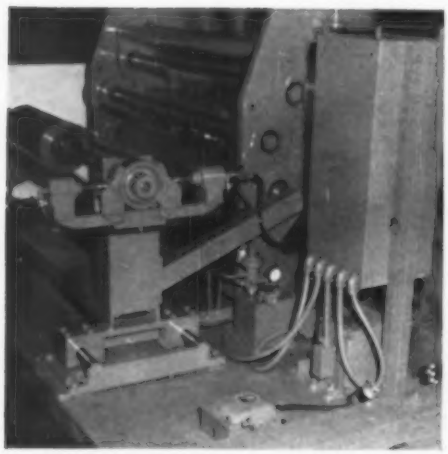
Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario

6208-1

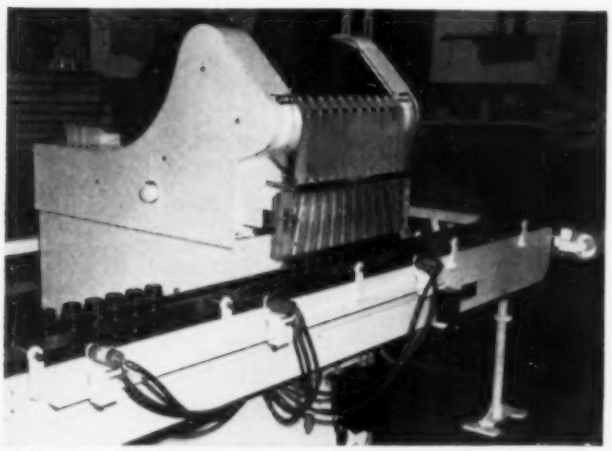
BRIEFS continued

PNEUMATICS FOR PACKAGING PRODUCTS

Packaging is and has been for many years a high production operation. Because packaging people recognized the need and were willing to pay for speed and reliability many years ago, mechanically operated devices were introduced and are still widely used. Application of fluid powered devices is comparatively new to this field. A tour through the Packaging Machinery Exposition in Cleveland held early in September showed a number of uses of compressed air. Here are four examples of how the packaging industry is using air circuits to reduce machine costs and increase speed of production.



SLITTER-REWINDER uses compressed air to operate the unwind brake and to operate rewind shaft clutches when locked core rewinding is needed. Built by Cameron Machine Company, this piece of packaging machinery uses a hydraulically operated material edge control unit. This compact pump, tank and valve unit is seen in the foreground with a pressure gauge mounted on it.



THREE small air cylinders are used to group bottles on the tablet counting machine made by United States Automatic Box Machinery Co., Inc. Automatic operation is achieved with cam actuated air valves. Position of air cylinders is easily varied to change bottle grouping. Each machine includes a small air compressor.

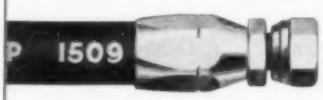
APPLICATION of labels is powered by air cylinders. Bottles flow continuously through this machine, built by Economic Machinery Corporation. It's a straight line labeler which spaces and controls the glass containers throughout the machine cycle. Any combination of labels can be applied to each container. Positive adjustable pressure control on the labels is obtained with combination pressure regulator-filter-lubricator units.

CASE LOADER for fibre board boxes was shown by the St. Regis Paper Company. At 70 psi, a force of 750 lbs is exerted by the main air cylinder as it pushes filled packages into a waiting fibre board box. This loader is readily converted into a baler for inserting packages into bags.

How Aeroquip Flexible Hose Lines Simplify Fluid System Design and Installation

TYPICAL AEROQUIP HOSE TYPES AVAILABLE

Aeroquip 1503 and 1502 Single Wire Braid Hose and Reusable Fittings are recommended for medium pressure hydraulic, lube and fuel oil, water and air lines up to 3000 psi. Sizes from 3/16" to 3".



Aeroquip 1509 Double Wire Braid Hose and Reusable Fittings are recommended for high pressure hydraulic, grease, fuel and air lines up to 4500 psi. In sizes from 1/4" to 2".

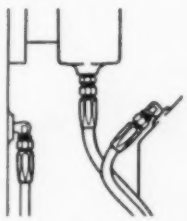
Aeroquip 2802 Teflon Hose and Reusable ***"super gem"*** Fittings are recommended for chemical, steam, hot asphalt and other corrosive fluid lines. In sizes from 1/4" to 1 .

Aeroquip 1525 Cotton Braid Hose and *SOCKETLESS** Fittings are recommended for oil, fuel, air and water lines on engines and other applications up to 250 psi. In sizes from 1/4" to 3/4". *(Patent Applied For).

Write for full information

SOCKETLESS and ***"super gem"*** are Aeroquip Trademarks

More simplified and compact fluid system designs can be achieved in many cases through proper application of flexible hose lines. The basic design advantage lies in the fact fewer "parts" are required. A single flexible hose line can be used where elbows, formed tubing sections and assorted adapters are needed using rigid tubing or piping. Flexible hose lines also offer great advantage on fluid systems subject to flexing, vibration and stress.



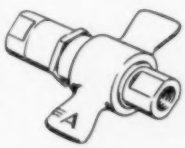
A wide variety of hose types is available to the designer. Aeroquip, for example, now produces 55 different hose types. Some have been developed primarily to carry special fluids. Others have been developed to withstand constant flexing, vibration, surge pressures, extreme temperatures.

REUSABLE HOSE FITTINGS

Aeroquip Hose Lines are unique in that every Aeroquip Fitting is detachable and reusable. In designing fluid systems, reusable fittings offer two advantages. First, mock-ups can be made and modified easily using hand tools to make up hose assemblies. Second, hose assemblies can be quickly made up in production quantities from bulk hose and reusable fittings without installation of expensive swaging machines in a manufacturer's plant. This benefit is also passed on to the equipment purchaser when replacement hose lines are needed. A small supply of bulk hose and a few spare fittings can be used to make quick replacements in the field. Aeroquip maintains an extensive network of distributors to serve users of Aeroquip Hose Lines.

SELF-SEALING COUPLINGS

Where fluid lines or systems require connection and disconnection for periodic inspection or maintenance, Self-Sealing Couplings can simplify design. Replacing two shut-off valves, a Self-Sealing Coupling permits disconnection of lines under pressure without loss of fluid or inclusion of air into the system. Aeroquip manufactures six types of Self-Sealing Couplings, for general industrial use, aircraft systems, Freon systems, LP-Gas fuel tanks, railroad diesel fueling and farm implement hydraulic systems.



FREE ROUTING AND INSTALLATION GUIDE

To help in planning and installing flexible hose lines, Aeroquip has prepared a handy 16-page guide covering flexible applications, bend radii, routing to avoid abrasion, heat damage, flexing failures, etc. Write for your copy today.

Complete engineering assistance is available to manufacturers.

Aeroquip Corporation,
Jackson, Michigan
Please send_____copies of "Guide for Routing and Installation of Aeroquip Flexible Hose Assemblies."

Name_____

Title_____

Company_____

City_____ Zone____ State_____

Aeroquip

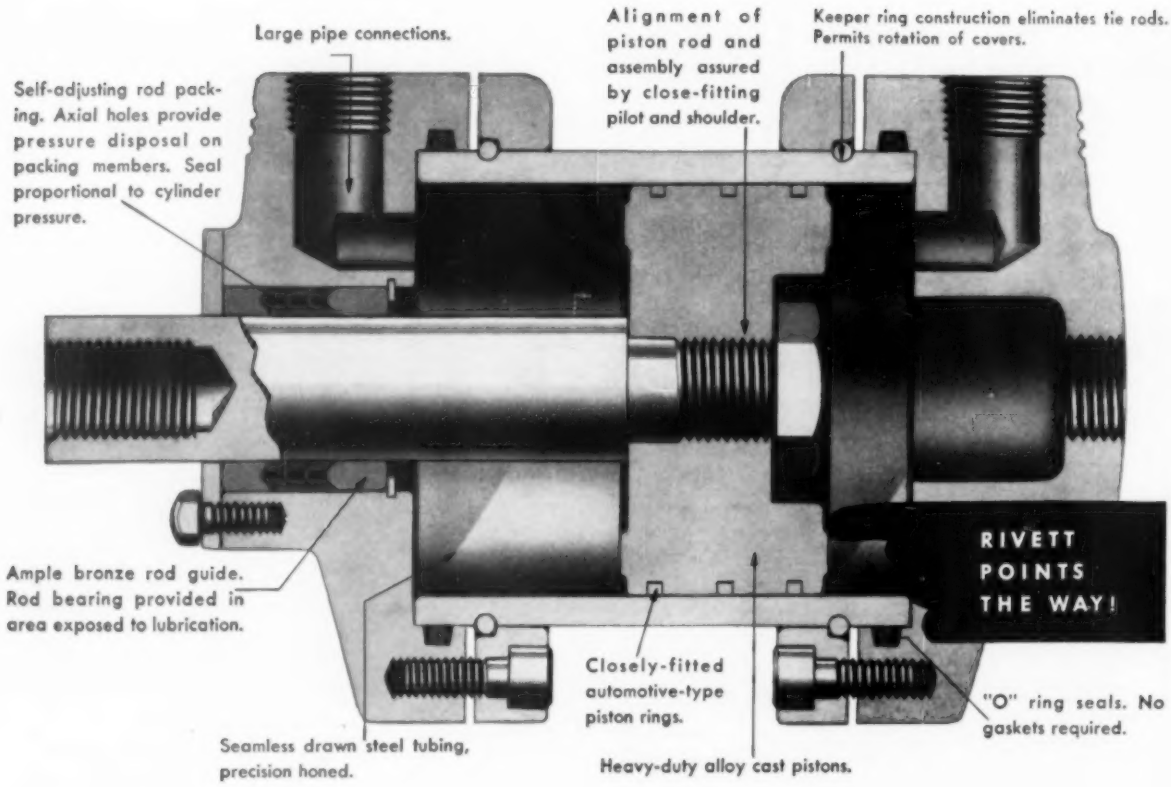
REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

IN CANADA: AEROQUIP (CANADA) LTD., TORONTO 15, ONTARIO

SOCKETLESS Fitting Patents: Great Britain 740,428; France 1,088,423; Austria 185,178—Patents pending in U.S.A., Canada, and other countries.

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD


Large pipe connections.
Alignment of piston rod and assembly assured by close-fitting pilot and shoulder.
Keeper ring construction eliminates tie rods. Permits rotation of covers.
Self-adjusting rod packing. Axial holes provide pressure disposal on packing members. Seal proportional to cylinder pressure.
RIVETT POINTS THE WAY!
Ample bronze rod guide. Rod bearing provided in area exposed to lubrication.
Closely-fitted automotive-type piston rings.
"O" ring seals. No gaskets required.
Seamless drawn steel tubing, precision honed.
Heavy-duty alloy cast pistons.

Sealing efficiency improves with increased pressure in Rivett 1500 PSI* Cylinders!

*Higher on application.

- External "O" Rings Act As Static Seals To Eliminate Gaskets And Assure LEAKPROOF OPERATION!
- Automotive Type Piston Rings Reduce Friction, Increase Sealing Ability, Permit Sensitive Response To Any Pressure.
- Keeper Ring Construction Eliminates Tie Rods.
- Self-Adjusting Rod Packing Cuts Friction.
- Unfailing Power For Millions Of Cycles.

1080 SELECTIONS!

7 mountings; 10 bores; standard and 2:1 over-size rod; single and double end rods; internal or external thread; cushioning either or both ends; special covers.

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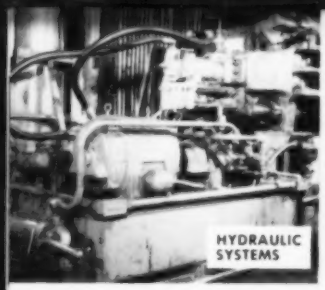
Brighton 35, Boston, Mass.

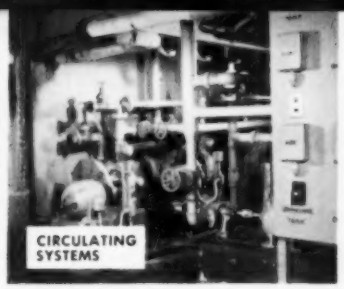
Get Catalog No. 106 to aid your circuit design. Complete drawings, specifications, cut-away views, tables, diagrams!

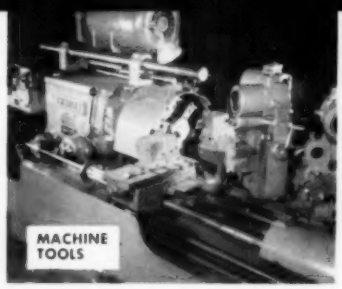
Member National Fluid Power Association

THE BETTER YOU KNOW HYDRAULICS
THE BETTER YOU LIKE

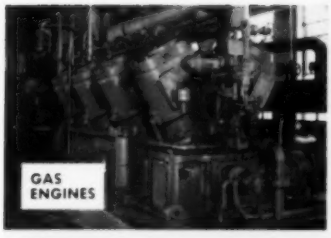
RIVETT
"100"
HYDRAULIC CYLINDERS

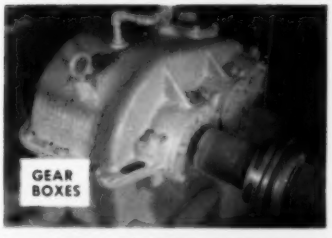


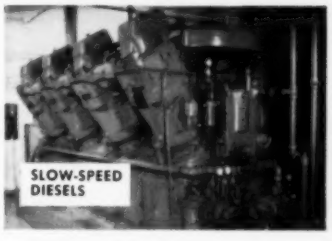




GENERAL LUBRICATION







SUN SOLNUS OILS IDEAL LUBRICANTS FOR 80% OF ALL APPLICATIONS

Moderately priced...low in carbon-forming tendencies, Sun Solnus® oils simplify your storage problems by doing with *one oil* many jobs that would otherwise require *several.* Their ability to protect metal parts against corrosion, their resistance to oxidation, and their moderate price all add up to "more lubrication per dollar."

For technical information, see your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-51.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

PHILADELPHIA 3, PA.

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Valve on left is from compressor run for 3,000 hours with well-known, high-grade oil. At right is same valve after a 3,000-hour run with Sun Solnus oil. Note difference in carbon deposits.

3000-HOUR TEST PROVES SUN SOLNUS OILS REDUCE CARBON BUILD-UP IN COMPRESSORS

Equipment: A three-stage Norwalk horizontal-type compressor. Operating pressure: from 1,000 to 1,500 psi.

Test: The compressor was cleaned thoroughly and filled with a well-known, high-grade oil. The equipment was run for 3,000 hours, then torn down for inspection and cleaning. Then Solnus* 300 was tested in the same way.

Results: Look at the two pictures. You can see for yourself how Solnus oil reduced dangerous carbon build-up.

All types of reciprocating air compressors that have been changed over to a Sun Solnus oil show similar results. A test in your compressor will show the same remarkable reduction of carbon deposits.

You can get a technical bulletin about Sun Solnus oils by asking your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-52.

SUNOCO®

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BRIEFS continued

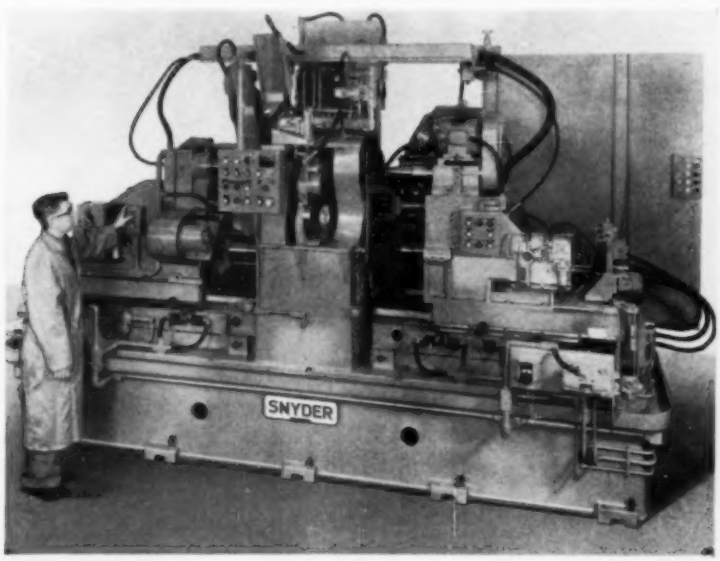
High Pressure Standards

• **To 200,000 psi**—Development of instruments and standards to permit accurate measurements of pressures up to and over 200,000 psi is being undertaken by the National Bureau of Standards. Where are such pressures needed? In the fluid power field such pressures are today being used in the production of artificial diamonds. Some extrusion of metals and plastics is being done in this ultra-high pressure area. In the field of chemical technology these high pressures are finding a number of applications.

• **Lines of approach**—one principal effort of the Bureau is on the development of piston gages for absolute measurement of pressure up to 200,000 psi. Other objectives of the program are (1) determination of a series of fixed points on the pressure scale; (2) establishment of standards for calibration of dynamic pressure measuring instruments; (3) investigation of the properties of working pressure gages such as those which utilize changes in electrical resistance with pressure; and (4) design and construction of mercury columns to serve as primary standards and for measuring differential pressures of several atmospheres at total pressures up to 30,000 psi.

• **Gage design**—The type of piston gage in use at the Bureau was designed by D. P. Johnson of NBS and D. H. Newhall of Harwood Engineering Inc. This gage has the novel feature that the clearance between piston and cylinder can be conrolled by an in-

Continued on page 38

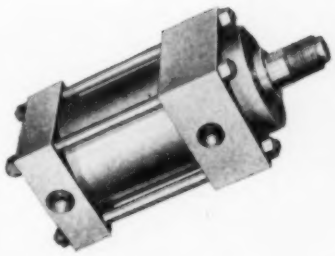


Six-station trunnion-type, two-way precision boring machine performs both machining and automatic assembly operations. Designed and built by Snyder Tool & Engineering Co., the machine has six precision boring spindles, utilizes a rotary hopper feed to direct split babbitt bushings to a plunger for press-fit assembly into the part at the fourth station. Deflection of the part during assembly operation is prevented by a hydraulic stop that advances to within 0.002 inch of the back face of the part. The machining cycle on the hydraulically operated, electrically controlled machine is entirely automatic.

← Circle 129

MUNTON AIR CYLINDERS

- **Double Acting**
- **200 P.S.I. Non-Rotating**
- **Standard Mountings**



- **Proven Construction**
- **Square Type—Tie Rod**
- **Brass Body—Bronze Rod Bearing**
- **Steel Head and Cap**
- **Chrome Plated Piston Rod —Rod Scraper**
- **Stress Proof Tie Rods— S.A.E. Threads**
- **Bronze Cushions**

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Manufacturers of; Air Cylinders—Hydraulic Cylinders—Hydraulic Vices—Presses—and Foot Power Units.

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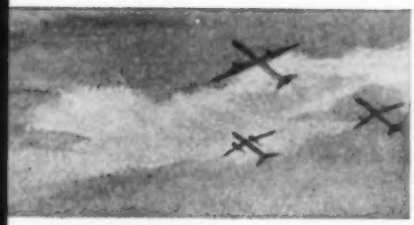

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That means single source convenience and single source responsibility for all your hydraulic problems in marine and ground defense applications.

With combined know-how of the two most experienced hydraulic engineering groups . . . with the most comprehensive line of hydraulic equipment anywhere . . . and with the manufacturing capacity of 6 dispersed Vickers plants . . . these new facilities are unrivaled in the entire field.

We welcome the opportunity of working with you on your marine and ground defense hydraulic requirements. We have specialized in the design of completely integrated hydraulic systems for over fifty years and can also supply almost any combination of standard or special hydraulic components.

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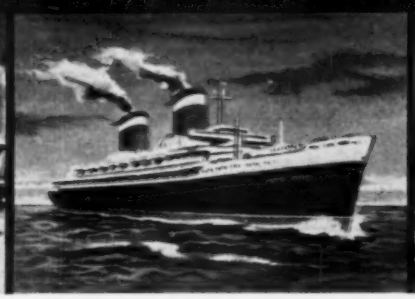
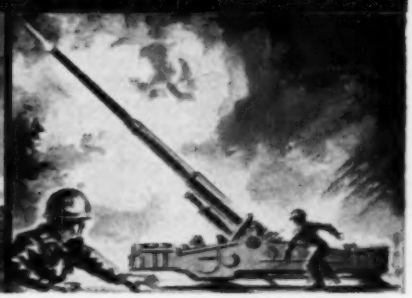
Hydraulic equipment for tanks, tank retrievers, half tracks, test stands, test installations, locks and dams.



Marine and naval hydraulic equipment for winches, cranes, fin stabilizers, steering gear, windlasses, hatches.



Hydraulic equipment for fire control systems, missile launching and handling, ammunition hoists, anti-aircraft weapons.

There's safety in these NEW numbers

UCON BRAND Hydrolube 150-CP

(Viscosity—approx. 150 S.U.S. at 100° F.)

UCON BRAND Hydrolube 275-CP

(Viscosity—approx. 275 S.U.S. at 100° F.)

Yes, there's safety in these two new grades of UCON Hydrolubes —CARBIDE's safety hydraulic fluids.

Greater safety for machines

These new UCON "CP" Hydrolubes...

- Contain improved liquid and vapor phase corrosion inhibitors for the common metals.
- Have good lubricity. Special anti-wear agents provide improved pump life and performance characteristics.
- Have high viscosity indexes—150 to 160.
- Have low pour points—can be used at sub-zero temperatures.
- Have no harmful effects on packings and seals. Leakage losses are often lower than with other hydraulic fluids.
- And, are made in the two standard viscosity grades—others can be supplied to fit specific requirements.

Safety for men and property

- The resistance of UCON Hydrolubes to burning has been proved by years of exhaustive testing in the laboratory and, by more than 8 years of practical application under standard industrial conditions. UCON Hydrolubes are water-base hydraulic fluids—the water content is the key to their fire-resistance.
- And, for all practical hydraulic purposes, UCON Hydrolubes are non-toxic to workmen.

For safety's sake, get all the facts. Write *today* for the new booklet, "UCON Hydrolubes Spell Safety," Form 40134.

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BRIEFS continued

dependent pressure applied externally to the cylinder. Control of this clearance makes it possible to calculate the pressure under the piston with greatly improved accuracy. The design also permits insertion of different piston-cylinder combinations so that the pressure range can be varied from 0-5,000 psi to 0-200,000 psi.

Two such instruments are currently in use at the Bureau for measurements in ranges 0-20,000 psi and 0-60,000 psi. ▼▼▼

Booster Application For Punch Press

Weight and space were principal considerations when Womack Machine Manufacturing Co., Dallas, were requested to design and build a 15 ton punch press for a 20 inch blanking die. The work

required a deep throat press, preferably a self-contained hydraulic unit.

Key to the design was the use of a double acting air-to-hydraulic booster with the return stroke powered by air pressure. With air on the lower side of the piston and oil on the upper side, the booster was mounted high to insure self-bleeding of any air that might get into the high pressure oil circuit.

By placing 4 inch cylinders on the guide posts and using long guide bushings, the necessary 15 tons to pull the die down was de-

Continued on page 40

When the pressure is on...

For leakproof connections...
that defy vibration and high pressure

specify

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When the pressure is on and positive vibration-resistant connections are a must . . . specify Weatherhead Ermeto® Connectors. Installation can be made in seconds with standard bench tools. There's no flaring . . . no threading . . . no welding . . . no soldering. The cutting and bowing action of the sleeve assures an unyielding leakproof seal . . . a joint that can be disassembled and reassembled time and time again. Write your nearby Weatherhead Distributor for detailed data.

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IMMEDIATE DELIVERY

ANY BORE SIZE • ANY MOUNT • ANY STROKE

CYLINDERS

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- **100% EXPANSION OF FACILITIES**
  Carter is geared to give service. We have increased our plant capacity to handle orders on an IMMEDIATE DELIVERY basis.
- **THE EXCLUSIVE CARTER DESIGN**
  Carter cylinders are designed for fast production and immediate off-shelf assembly from standard parts.
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  Carter produces around the clock. Your order for cylinders is in process *in a matter of minutes* after we receive it.
- **SPARE PARTS AND SERVICE**
  Carter maintains complete spare parts and experienced engineers in 40 different locations throughout the United States, Canada, and Mexico.
- **PHONE 24 HOURS A DAY**
  Call in your order any time of the day or night. Carter will take your order and begin processing it right away.

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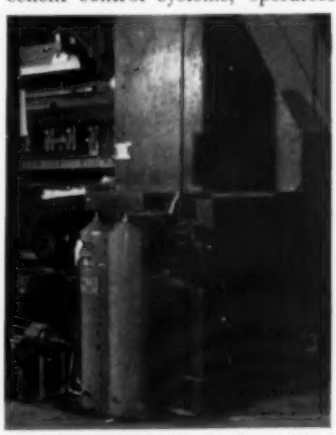
ROTARY ACTUATORS • SPECIAL CONTROLS

BRIEFS continued

veloped. The circuit is controlled by a double solenoid 4-way air valve, operated by dual hand switches. At the end of the down stroke a limit switch reverses the valve and allows air pressure to return the cylinders and die to their top, starting positions. Power source is 80 psi shop air. ▼▼▼

Oil Filtration Increases Production

• **Grit and dust problem**—Use of hydraulic machine tools in the production of coated abrasive belts and sanding discs at Behr-Manning Company did not result in the immediate production increase hoped for. In spite of excellent control systems, operators

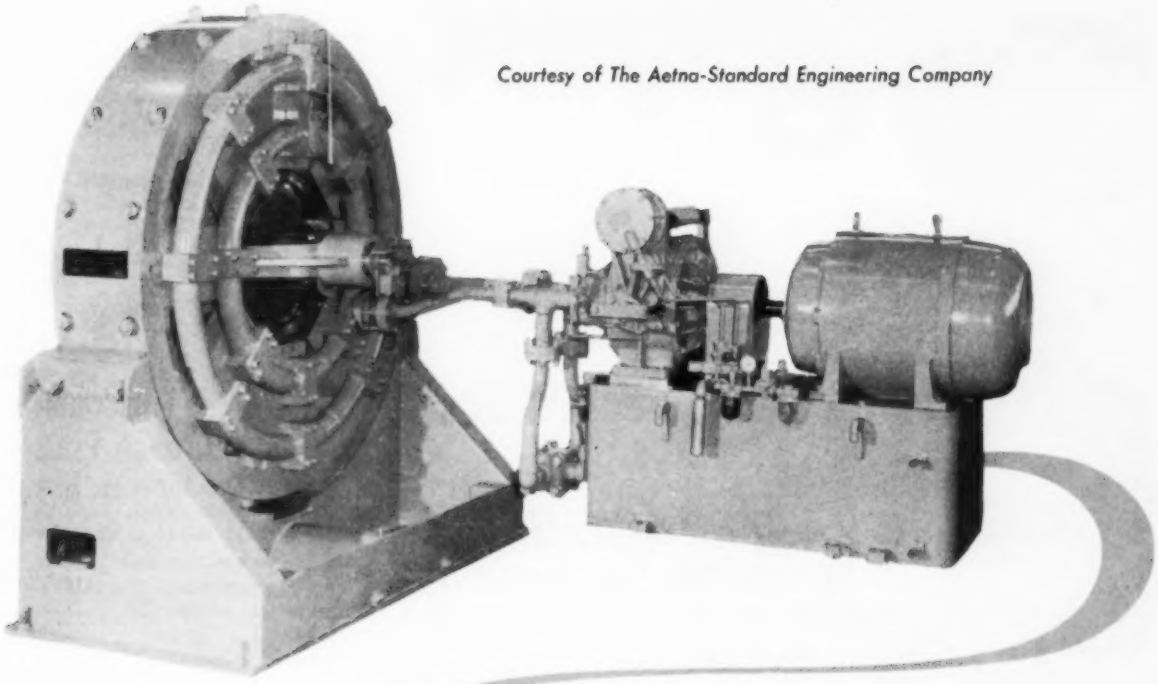


were having trouble with sticking control valves. This was traced to a large amount of grit and sludge in the hydraulic oil.

• **Filter installations**—In an attempt to overcome operating difficulties, three Hyflow oil filters were installed on a by-pass basis on three hydraulic systems. Reduction of down-time prompted the company to equip eight more presses with these filters. Pump wear and valve sticking which was relatively common on these hydraulic systems became a thing of the past. All hydraulic systems are now equipped with these hydraulic filters.

One of the most important gains was the continuous production

Continued on page 42



Courtesy of The Aetna-Standard Engineering Company

This is a SQUEEZE POINTER

It is used to reduce the diameter of one end of a tube preparatory to cold drawing.

The squeeze pointer consists of eight hydraulic cylinders uniformly spaced in a circle and acting radially toward the center. As these cylinders are reciprocated, a tube is fed into the die at the center and is thereby "squeeze pointed."

The LASSMAN hydraulic pump and control unit which powers the pointer operates under severe conditions. At a pressure of 3000 p.s.i., it causes the pointer to produce one 600 Ton "squeeze" approximately every second, yet at this frequency, the reversals are smooth, quiet and shock free.

Equally noteworthy is the fact that except when high ambient temperatures prevail, no oil cooling is required even under continuous operation.

Such service features as these point up the quality of LASSMAN hydraulic engineering and equipment which mean top performance at high efficiency and low maintenance.

We will be pleased to have your inquiries.

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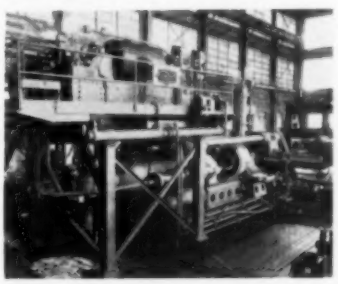
BRIEFS continued

available from all equipment. Filter cartridge life averages 12 to 18 months between changes. Oil changes have been practically eliminated and mechanical maintenance reduced by 75 percent. All of the filters were installed with individual motor pump units. ▼▼▼

2,750 Ton Hydraulic Extrusion Press

First of three presses, engineered to make extrusions from billets 8 to 12 inches in diameter and 32 inches maximum length, has been shipped to Kaiser Aluminum & Chemical Corp., Halethorpe, Md.

The four-column, self-contained hydraulic press—built by Birdsboro Steel Foundry & Machine Co.—has a specially designed die slide which permits insertion of a



die stack in either of two locations, letting the extrusion proceed through the die while a second die stack is inserted, removed or dressed.

The hydraulic system on the machine consists of two constant delivery pumps at 108 gpm, and one electronically controlled variable delivery pump at 108 gpm. An additional pump and motor are used to seal the container at 3000 psi. Large coolers and the circulating pump keep the hydraulic oil cooled. The main pumps are provided with motor capacity totalling 550 hp. The main ram rapid advance speed is 626 inches per minute, the extrusion speed is variable without steps to 37.5 inches per minute, and the return speed is 342 inches per minute. ▼▼▼

Continued on page 44

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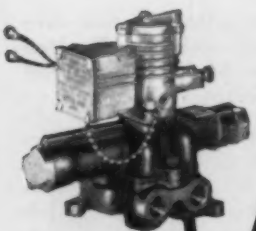
is everywhere



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Valves — by Valvair — are everywhere . . . on the best production and automated equipment . . . in mills, factories, foundries and assembly plants.

That's because they deliver *performance.* Users report Speed Kings are still working satisfactorily after 25 million cycles. And they're *guaranteed against coil burnout* for the life of the valve. What's more, with Valvair valves you pay for only the features you want for your specific application.

And equally important, Valvair has sales-service representation in all major industrial areas. So bring your valve problems to Valvair *first*—for Valvair is everywhere. A call will bring our representative on the double. Valvair Corporation, 454 Morgan Avenue, Akron 11, Ohio.

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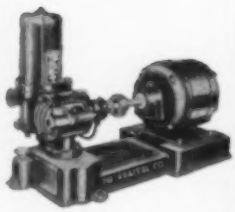

Rotary Air Pumps for vacuum bottling

Kraissl's patented, automatic, force-feed lubrication and flushing system makes these direct-drive, high-capacity pumps ideal for the special requirements of bottle-filling machinery.

Air-cooled design—or water-cooled models for heavier duty.

Class 21 roller-action pumps are recommended for handling corrosive gases and extraneous matter that might jam with closer clearances. The multi-blade design of the Class 25 pumps gives higher capacity efficiencies and is designed for applications requiring higher degree of vacuum.

Where water-cooling is desired for continuous service, the water-jacketed Class 25-WJ models are recommended.

Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

Write today for Bulletin A-1289, for air-cooled pumps—and for A-1523 for the water-cooled models.

KRAISSL CO

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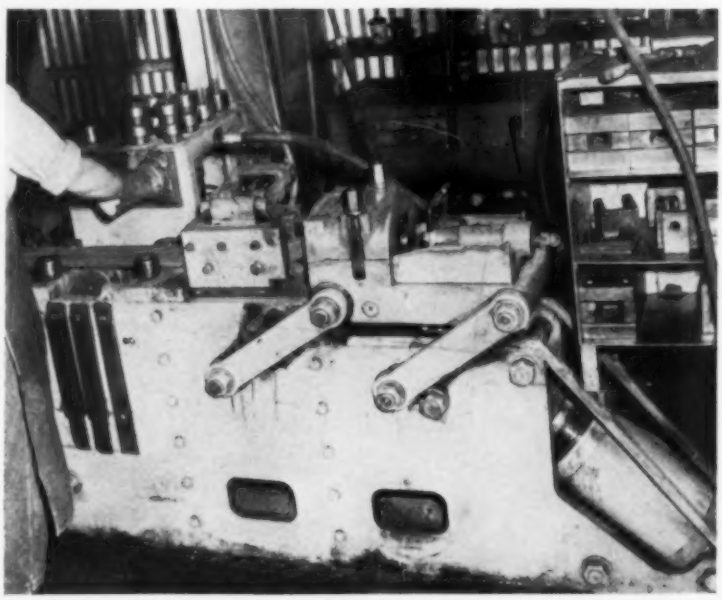
BRIEFS continued

Hydraulics Cuts Production Costs



• **Time and Tool Savings**—To produce drop forged axles for automotive equipment by machining and forging 1½ inch to 4 inch square and 1½ inch to 3½ inch round types of 1040 and 1045 carbon steel bar stock, a new type hydraulic press has been built for Hadco Engineering Company.

Forging is necessary to produce bends or drops in the bars. If it is conventionally done with hammer equipment, the stock must be machined during secondary operations in order to maintain critical dimensions. The new press, used in conjunction with induction heating equipment, permits the forging of bars after they are machined. In addition to saving the cost of special tooling, it also saves considerable setup time.

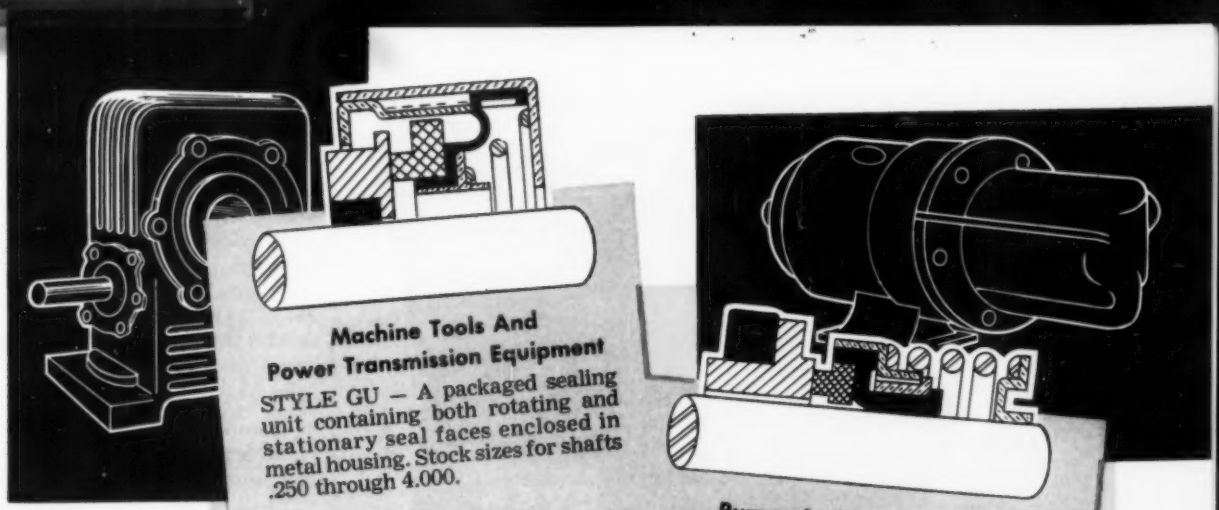
• **2000 psi**—The press uses an eight inch hydraulic cylinder to exert 2000 psi pressure on an upward moving ram and steel bending die. Although forging temperatures of 2000 degrees F are specified, each heating operation is accomplished in a matter of seconds due to the use of electronic energy and induction coils. As soon as a specified steel area is properly heated, a worker removes the component to be forged from an induction coil and inserts it in the press. He then actuates the cylinder and the forging operation is completed with a single ram movement in less than 30 seconds. ▼▼▼

"Yes Man" Fed With Fluid Power

The most dexterous master-slave manipulator—nicknamed Yes Man—has been developed by General Electric Company engineers.

• **Electro-hydraulic design**—The system consists of two master arms, one left and one right, each with two fingers and a thumb; left and right arms on the slave with corresponding finger arrangement; two separate hydraulic pumps, two groups of electro-hydraulic valves and a rack of electronic amplifiers. The electro-hydraulic valves convert the electri-

Continued on page 46



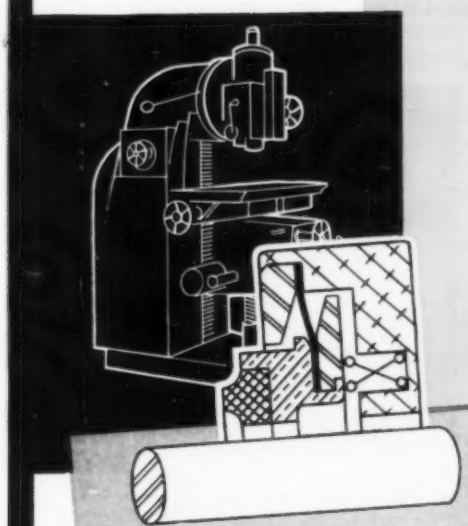
Machine Tools And Power Transmission Equipment

STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.

Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

A Complete Line

GITS SHAFT SEALS

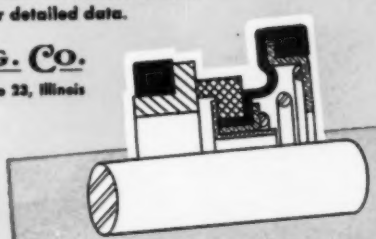
For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

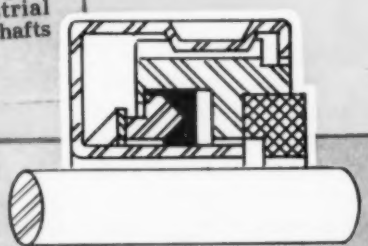
1846 South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



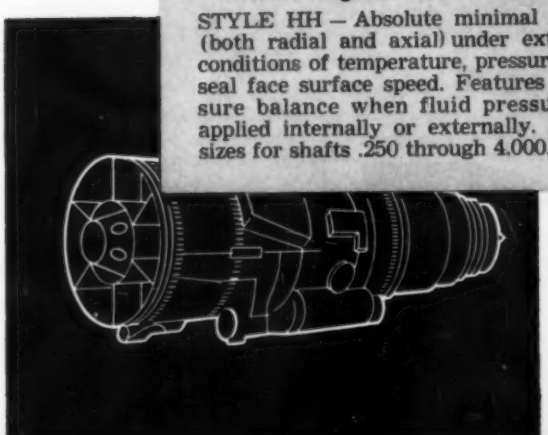
Household Appliances

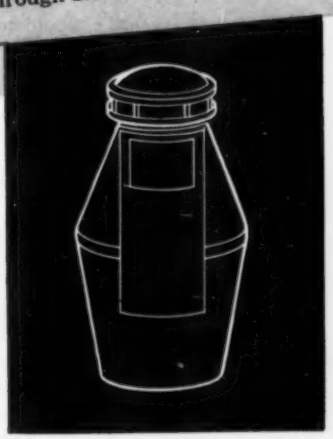
STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.





ONE OF THE GARLOCK 2,000

SERVICE REPORTS ON THIS PACKING EVEN SURPRISED US!

Typical Service Reports on Lattice Braid Asbestos Packing with Teflon:

- Outlasted another Garlock Style 10 to 1 against blending waxes and steam for cleaning.
- Outlasted competitor's packing 38 to 1 against caustic at 325°F., 50 psi.
- Outlasted other packings 3 to 1 against cold water.

Don't take our word for the greater strength, longer life of LATTICE BRAID with Teflon—try an initial order of 10 or more feet today. The Teflon core and impregnation resist everything except molten alkali metals.*

And, remember, LATTICE BRAID with Teflon is only one of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals to meet every conceivable need. It's the *only* complete line available. It's one reason why you can expect unbiased recommendations from your Garlock representative. Call him, or write for booklet 131.

THE GARLOCK PACKING COMPANY,
Palmyra, New York

For Prompt Service, contact one of the 30 sales offices and warehouses throughout the U.S. and Canada.

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints

BRIEFS continued

cal signal into hydraulic power, which in turn operates the slave and gives the master its ability to "feel". The slave is a virtual twin to the master except that it has claw-like fingers on each hand and has no operator's seat.

• **Simple operation**—To perform a given mechanical task, the operator seats himself in the master seat, straps his own arms and fingers into the mechanical arms and fingers and watches the slave duplicate each motion he makes. Instead of pushing buttons and

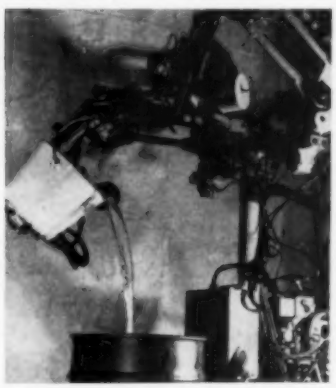


Illustration shows the slave's left arm lifting a pail of water while the right hand tips the full pail of water into the center of a barrel. The machine is remote controlled from any practical distance.

controls, the operator actually goes through the desired arm and finger motions for the task at hand. Operating the master, he can actually feel the force encountered by the slave while tackling the work.

• **Various applications**—Designed primarily to do work in radioactive areas where it is too dangerous for mechanics to work, the machine can also handle wrenches, drills, hammers and other tools and work accurately with almost-human skill. ▼▼▼

New Synthetic Material

After several years of research, development and testing, Greer Industries, Inc., has produced a new

Continued on page 48

New ASCO 3-Way Solenoid Valve assures MILLIONS OF TROUBLE-FREE OPERATIONS

NO EQUAL IN SIMPLICITY!

Simplicity is the secret of this remarkable, new 3-way diaphragm valve. It has *only three operating parts.* Compare this with the larger number of parts found in conventional 3-ways! That's one reason why the new ASCO valve means trouble-free operation . . . substantial savings in maintenance costs . . . reduction in down-time losses.

SIMPLICITY IN OPERATION

Not only its construction but also its new operating principle is the essence of simplicity: solenoid piloting of two simple diaphragms.

UP TO 400 CYCLES PER MINUTE

Exceptionally large flow capacity makes rapid recycling feasible . . . cylinders fill and vent rapidly . . . valve operates up to 400 cycles per minute over millions of strokes.

CONVERTS IN 30 SECONDS

Developed for dependable control of liquids and gases, the valve can be converted from normally open to normally closed or the reverse by simple rotation of the valve bonnet.

This new valve is absolutely tight seating . . . no closely fitted parts or valve seat grinding required. Available now in ⅜" and ½" pipe sizes, both with full ⅜" orifices, it can be mounted in any position.

WRITE NOW for your copy of ASCO Bulletin 8316, or have the ASCO Engineer call.

The EXTRA HEAVY FORGED BRASS BODY houses only three moving parts: Two diaphragms and a core. Corrosion protection is assured. All parts in contact with fluids or gases are brass, stainless steel or Buna-N.

ASCO

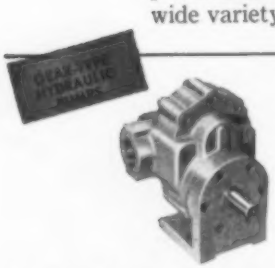
DEPENDABLE CONTROL

Automatic Switch Co. 385-H LAKESIDE AVENUE • ORANGE, NEW JERSEY

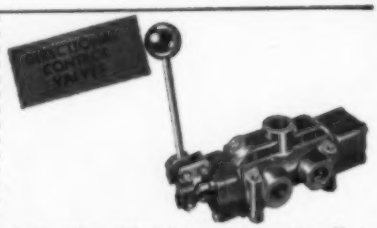
AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

ADEL *Industrial Hydraulic Equipment*

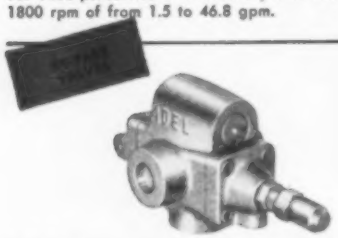
for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.



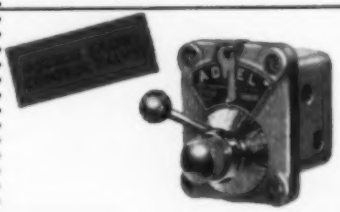
For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.



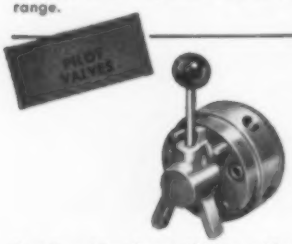
4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.



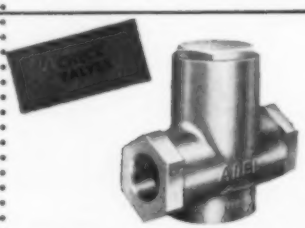
Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.



Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.



2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.



Valves allow free flow in one direction only. Many variations available. 3000 psi.

For complete engineering specifications and counsel, Address: ADEL PRECISION PRODUCTS, DIVISION OF GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

ADEL
PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

Manufacturers of Industrial Hydraulic Valves and Pumps

DISTRIBUTORS: AIR-DRAULIC EQUIPMENT CO., HOUSTON, TEX. • AIR & HYDRAULIC ENGINEERING CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND 14, ORE. J. BOYD COATES, GLENSIDE, PA. • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • FRANK T. DONNELLY COMPANY, PITTSBURGH 38, PA. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE 4, CALIF. • HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO 7, CALIF. • AIR-DRAULICS COMPANY, PHOENIX, ARIZ. • INDUSTRIAL AIR & HYDRAULIC EQUIP. CO., DETROIT 15, MICH. LINCOLN SUPPLY COMPANY, PROVIDENCE, R. I. • L. H. MONSEES, INDEPENDENCE, MO. • THE NEFF ENGINEERING CO., FORT WAYNE 3, IND. • POWER DRIVES, INCORPORATED, BUFFALO, N. Y. • SCOTT EQUIPMENT & ENGINEERING CO., DAYTON 10, OHIO • ROBERT TAYLOR & SONS, SALT LAKE CITY 10, UTAH • WYATT SALES COMPANY, CLEVELAND 15, OHIO TRI-STATE SUPPLY COMPANY, BROOKLYN 33, N. Y.

BRIEFS continued

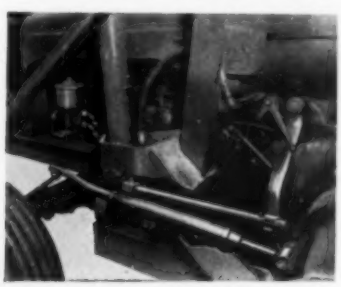
diisocyanate polyester elastomer. Designated Disogrin, the material has high tensile strength, extreme abrasion resistance characteristics, long life and resistance to high ozone concentrations. The material

is likely to find wide applications in the hydraulic and mechanical fields wherever sealing and abrasion are problems. Accumulator bladders, O-rings, U-cups, metal reinforced scrapers, bellows, valve seats and check valve buttons are among the products which incorporate Disogrin. ▼▼▼

Hydraulic Power Steering

Designed for attachment to Fordson-Major diesel tractors, Sherman Products, Inc. has developed this new hydraulic steering unit.

The steering device consists of a combination hydraulic servo



valve and cylinder which is actuated by the pitman arm of the tractor steering column. Hydraulic power to operate the unit is supplied by a self-contained pump and reservoir, driven by V-belt from the tractor's generator pulley. The unit makes steering particularly easy when the front of tractor is weighted down by a heavy attachment. Should for any reason the hydraulic system fail, the unit can still be manually steered. ▼▼▼

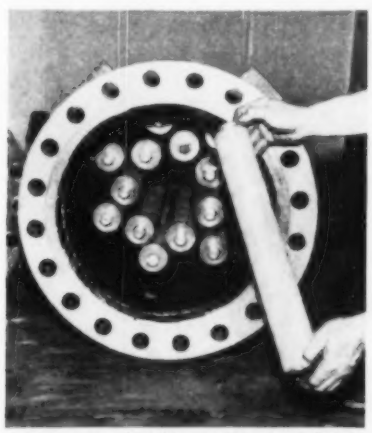
Continued on page 52

Tips on Selecting a Filter

Most filter needs fall into one of two categories that we can conveniently call product filters or functional filters. Occasionally, a combination of both is required.

Product Filters

A product filter—as suggested by the name—removes any particles that impair product quality or hurt sales appeal. Such particles can be captured and measured. Their size indicates the necessary degree of filtration. A good rule of thumb for selecting filter size here is: Select a standard filter spacing next smaller than the objectionable particle. In some cases, a safety factor may be obtained, at slight additional cost, by selecting the second smaller spacing.



FILTER FOR 400°F. This multiple Cuno PORO-KLEAN filter unit provides 3-30 micron filtration of 180 gpm of naphtha at 700 psi. It's typical of the wide range of filter problems tackled by Cuno engineers.

Functional Filters

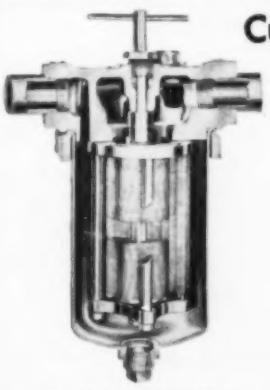
A good example of a functional filter is a unit installed to protect an orifice, nozzle, or similar part. Here, it's good practice to select a degree of filtration of approximately half the size of the aperture to be protected. However, the nature and number of contaminant particles will sometimes vary this choice. A drastic reduction in the degree of filtration may be called for by contaminants which agglomerate, or which might wedge into circular orifices, or which enter in very small sizes and settle to build up sludge at slow moving spots in a system. Selection of a filter for these applications is affected by the nature and cost of the unit it is to protect. In many cases, its price can be regarded as an insurance premium on the life or reliability of the system which it protects.

Combination Filters

A good example of the combination product and functional filter is one used in a rolling mill to prevent roller damage and finish scouring by particles in coolant. Here, it's the metal finish desired that determines to what degree the coolant is filtered. If final finish is unimportant, only large particles of dirt (say from 0.035" and up) need be removed. On the other hand, for fine 0.0015" aluminum foil you need a much finer filter to avoid damage to rolls or scouring. A micronic filter—such as Cuno's MICRO-KLEAN—is indicated here.

If you have filtration problems like these, your Cuno representative will be glad to help you work out the solution. Or write to The Cuno Engineering Corporation, 2-11 South Vine Street, Meriden, Conn. 6.1

Cuno case study capsule



Cuno's SUPER Auto-Klean

PROBLEM:

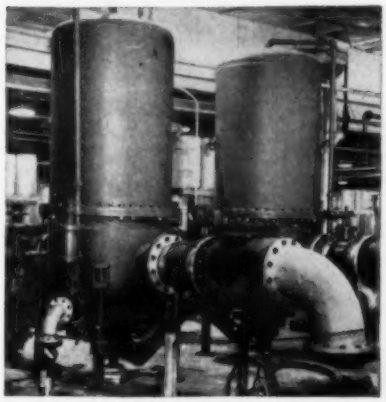
40 micron filtration of 35 to 45 gpm of SAE 20 or 30 lube oil for 6 and 8 cylinder diesel engines. Temperature 180° to 220°F.

SOLUTION:

Cuno's SUPER Auto-Klean. Manager of research stated that SUPER Auto-Klean removed at least 10 times as much dirt as their by-pass screens! And with no interruption to service for cleaning!

Another example of the wide application range of Cuno filters.

FILTRATION NEWS



CUNO FLO-KLEAN installed. These units filter 2500 gpm of water for steel mill.

Self-cleaning filter for up to 15,000 GPM!

Looking for sheer fluid-handling capacity in a continuously self-cleaning filter?

Then Cuno's FLO-KLEAN is the unit for you. It's particularly adapted to removal of sand, metal chips, abrasive wheel particles and similar solids from water, coolants, cutting oils and other light fluids—*in quantity*. Here are some outstanding FLO-KLEAN advantages:

Continuous self-cleaning—No interruption to fluid flow. No expensive duplex installation needed. FLO-KLEAN is cleaned by continuous backwash and occasional draining of accumulated particles. Automatic blowdown is available.

No loss of backwash fluid. All backwash is returned to system.

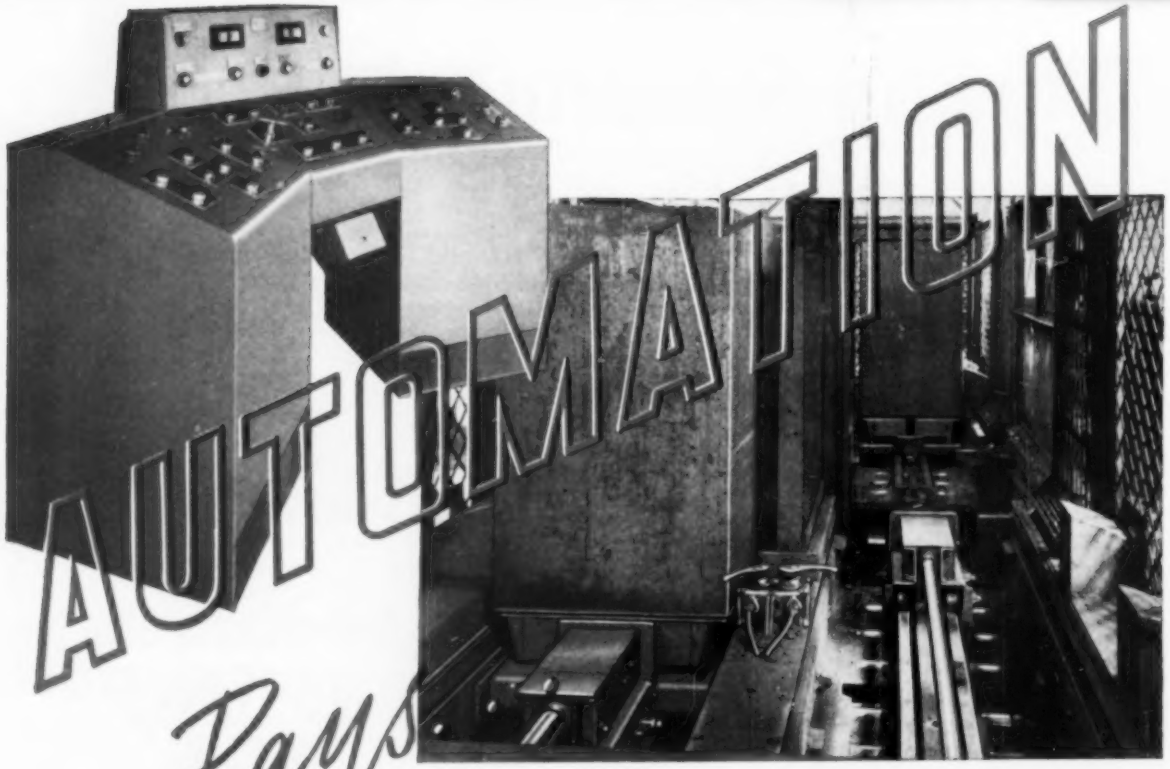
Positive removal of all solids larger than minimum specified particle size. Sizes run from 0.0025 to 0.030 inch (220 to 20, approximate screen equivalent).

Long life—A battery of FLO-KLEAN filters, installed in 1938, is still in operation. A FLO-KLEAN in an oil refinery ran 24 hours a day, seven days a week for 5½ years: total downtime 20 minutes due to plant power failure!

Write for complete technical data on this high capacity, self-cleaning filter for your industrial filtration problems. Ask for Catalog No. 052. The Cuno Engineering Corporation, 2-11 South Vine St., Meriden, Conn. 6.7

CUNO ENGINEERED FILTRATION

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridges)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous stainless steel)



Pays

COAL OUTPUT UP OVER 100%!

AT RAWDON

	BEFORE re-organisation	AFTER re-organisation	
MEN ENGAGED IN HANDLING			
ABOVE	66	8	MANPOWER BALANCE UPGRADED TO COAL-FACE WORK
BELOW	43	8	
NUMBER OF TUBS/CONTAINERS	650	6	INCREASED SAFETY WITH LESS MOVING MACHINERY
MAXIMUM TONNAGE PER HOUR	148.5	360	WOUND THROUGH ONE SHAFT INSTEAD OF TWO

THESE OUTSTANDING FIGURES—*reproduced by permission of the National Coal Board — illustrate the economy and efficiency of the Torley Container Automation powered and controlled by Keelavite Hydraulics at Rawdon Colliery in Leicestershire.*

Plan right with

Keelavite *hydraulics*

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

KEELAVITE ROTARY PUMPS & MOTORS LTD., ALLESLEY, COVENTRY, ENGLAND . . . . Telephone: Meriden 411

Canadian Agent: JOHN SPOTTON CO., LTD., 21 CARSON ST., TORONTO 14, ONTARIO

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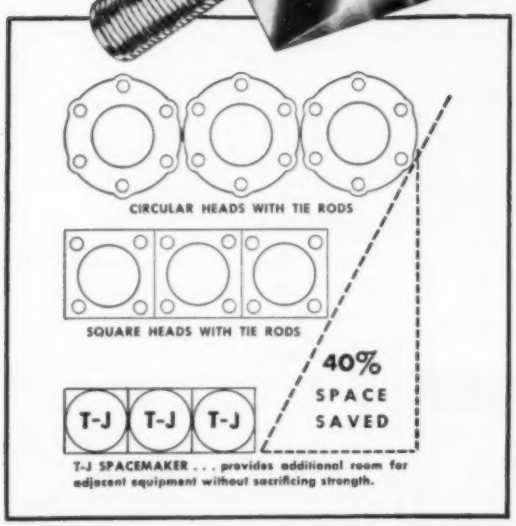
Saves 40% Space!

STRONGER, TOO

Than Outmoded Tie Rod Cylinders!



T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

NEW LITERATURE . . . send today for new Bulletin with complete details of Spacemaker line.

Only T-J Spacemaker CYLINDERS

Offer All The Extras As Standard!

- **NEW *exclusive* Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion**
- **Compact design eliminates tie rods, saves up to 40% space**
- **Proven Performance . . . with Extra High Safety Factor**
- **Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost).**
- **OIL pressure to 750—AIR to 200 P.S.I.**

You'll find many answers to *automation* in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Mich.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

T-J TOMKINS-JOHNSON

RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

Circle 132 on Reader Service Card

SAVE MONEY WHILE SPENDING IT!

Specify

HYDRO-LINE

AIR & HYDRAULIC CYLINDERS

SAVE SPACE...

SPEED PRODUCTION...

SAVE DOWNTIME...

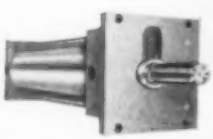
Compact design of HYDRO-LINE Cylinders with *exclusive* quick-change rod cartridge permits immediate replacement of rod seal, double lip rod wiper and rod bushing without removing or dismantling the main cylinder assembly. Other of HYDRO-LINE'S exclusive combination of features includes: all-steel end caps, one-piece piston retained by prevailing torque-type lock-nut, hard chrome plated piston rods, wrench-flats, heavy cushion adjusting needle valve interchangeable with ball check valve. Meet all JIC Standards.

WHEN YOU DESIGN . . . REMEMBER HYDRO-LINE!

SERIES R—Air or Low Pressure Hydraulic Heavy Duty Cylinder

TYPICAL APPLICATIONS

Clamping Fixtures
Loading & Unloading Devices
Counter Balance
Welding Machines
Air Clutches



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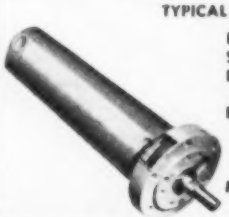
Bulletin Available at Later Date

SERIES J—High Pressure Hydraulic Extra Heavy Duty Cylinder

TYPICAL APPLICATIONS

Feed Cylinders
Slide Cylinders
Die Casting Shot Cylinders
Drilling & Tapping Machines



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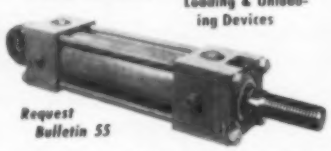
Request Bulletin 53

SERIES S—Air or Low Pressure Hydraulic Extra Heavy Duty Automation Cylinder

TYPICAL APPLICATIONS

Clamping Fixtures
Welding Machines
Automation Equipment
Loading & Unloading Devices

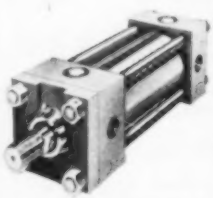


Request Bulletin 55

SERIES N—High Pressure Hydraulic Heavy Duty Cylinder

TYPICAL APPLICATIONS

Feed Cylinders
Welding Machines
Die Casting Machines
General Machine Tools



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Request Bulletin 56

• Hydraulic and Air Cylinders • Dispensing Cylinders • Single Acting Cylinders • Adjustable Stroke Cylinders • Intensifiers

Representatives in all Principal Cities. Write for the name of the Hydro-Line Rep in your locality.

YOUR SAVINGS BEGIN HERE!

Please send bulletin ☐ 53 ☐ 55 ☐ 56

NAME_____

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Hydro-Line CYLINDERS

Remember HYDRO-LINE when you design

HYDRO-LINE MANUFACTURING CO.

5605 PIKE ROAD • ROCKFORD, ILLINOIS

BRIEFS / continued

Future Events

November 24-30: ASME Annual Meeting, Hotel Statler, New York, N.Y.

November 26-30: 22nd National Exposition of Power and Mechanical Engineering. New York City Coliseum, New York.

November 26-30: Third International Automation Exposition. New York Trade Show Building, New York City.

January 14-18, 1957: SAE Annual Meeting and Engineering Display. The Sheraton-Cadillac and Statler Hotels, Detroit, Michigan.

January 28-31: Plant Maintenance and Engineering Show. Public Auditorium, Cleveland, Ohio.

January 30: ASME Philadelphia Chapter, Fluid Power Division. C. B. Frellsen, chief hydraulic engineer, Joy Mfg. Co., "Hydraulics in Mining Machinery".

March 20-22: SAE Production Meeting and Forum, Hotel Statler, Buffalo, N. Y.

March 25-29, 1957: 10th Western Metal Congress and Exposition. Congress will be held at Ambassador Hotel, exposition at Pan-Pacific Auditorium, Los Angeles, Calif.

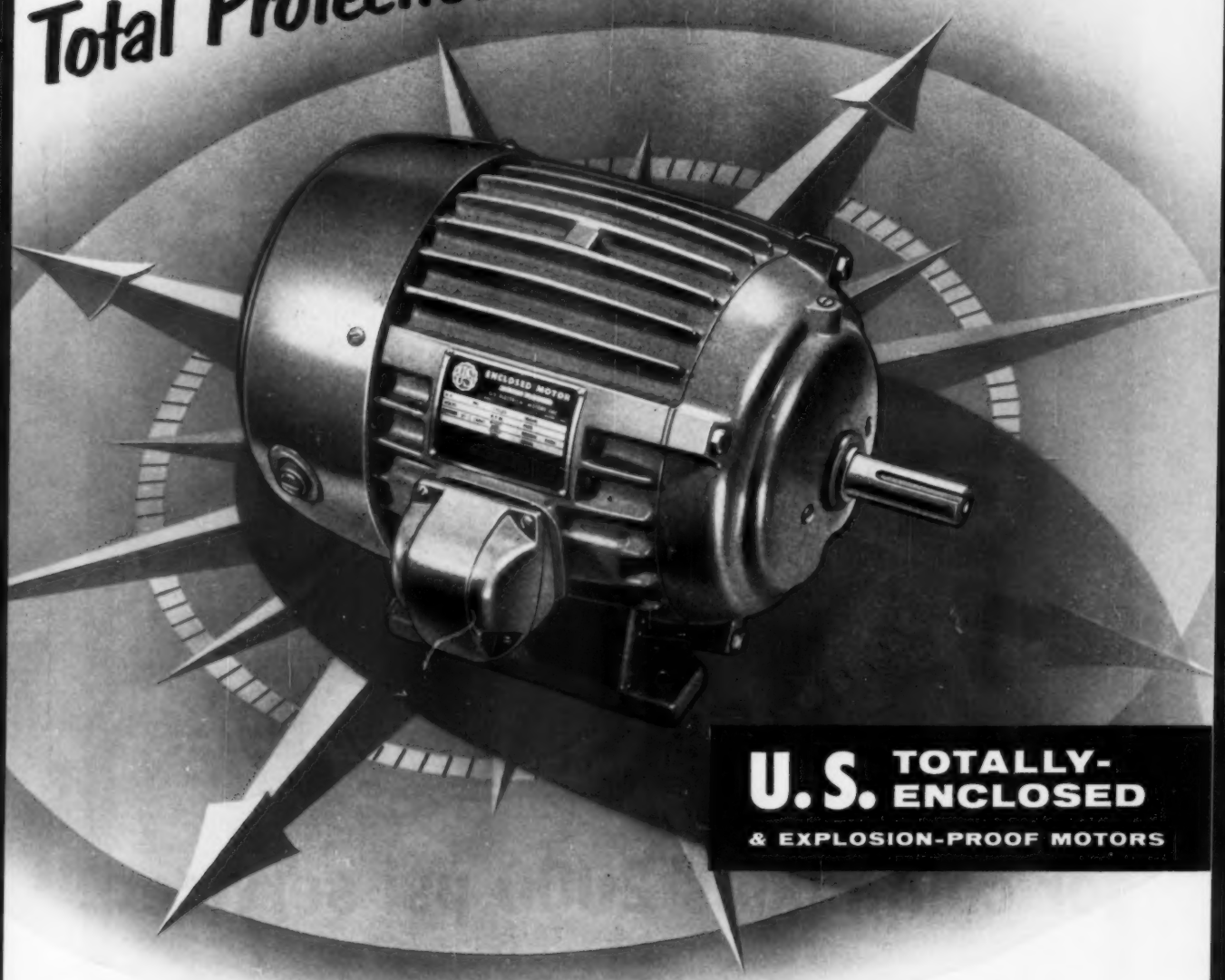
April 2-5: SAE Aeronautic Meeting, Aeronautic Production Forum, and Aircraft Engineering Display, Hotel Commodore, New York, N. Y.

September 9-12: SAE Tractor Meeting and Production Forum, Hotel Schroeder, Milwaukee, Wis.

October 1-5: SAE Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, The Ambassador, Los Angeles, Calif.

November 4-6: SAE Transportation Meeting, Hotel Statler, Cleveland, Ohio. ▼▼▼

Total Protection...in Every Direction



U.S. TOTALLY-ENCLOSED & EXPLOSION-PROOF MOTORS

Protected AGAINST EROSIVE POLLUTION...

...U. S. Totally-Enclosed and Explosion-Proof Motors provide all-around protection against corrosion, weather exposure, bad contaminants, caustic conditions, dust and erosive elements. All types are NEMA-dimensioned.

Protected AGAINST INTERNAL HEAT...

Asbestos protected windings, cooling ribs, and a heavy duty fan form outstanding features to give U. S. Totally-Enclosed motors maximum protection against heat.

Protected AGAINST BEARING FAILURE...

Lubriflush transverse re-Lubrication is possible without disassembly of motor or fan guard. Grease fittings are outside. Lubriflush forces out old grease and injects new lubricant around and through the bearings.

Protected AGAINST SHOCK AND VIBRATION

...The hefty cast-iron frame of the U. S. Totally-Enclosed motor is normalized to provide a non-stress, single-piece structure. Rugged feet are integrally cast with the frame; not welded on.

U.S. MOTORS — U.S. Electrical MOTORS

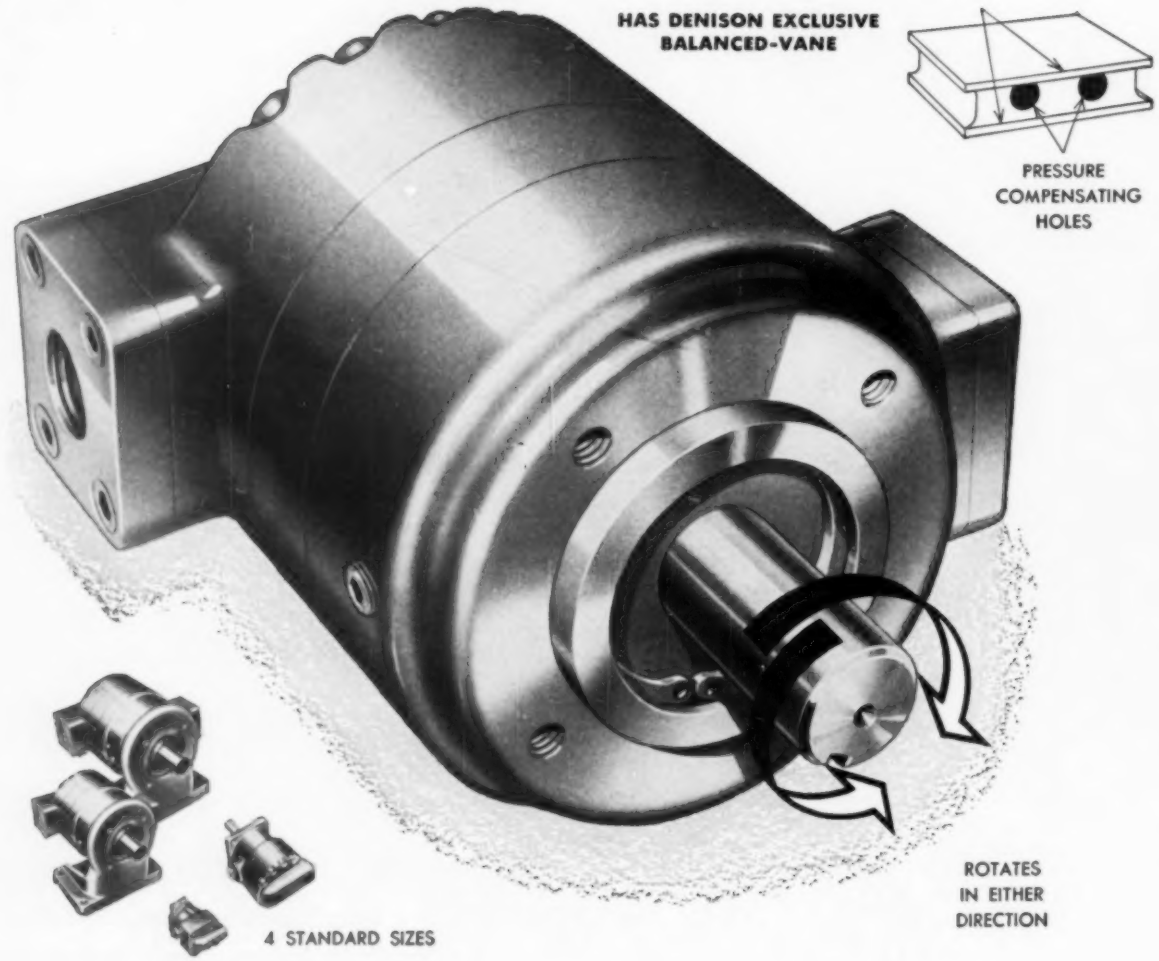
U. S. ELECTRICAL MOTORS Inc. AH-11
P. O. Box 2058, Los Angeles 54, Calif., or Milford, Conn.
☐ Send U. S. *Totally-Enclosed Motor Bulletin #1879*

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____



for continuous 2000 psi service...

Vane type Denison hydraulic single stage, Pump/Motor

IT'S A PUMP—high delivery in a small, compact package . . . a continuous 2000 psi pump.

IT'S A MOTOR—high stalled torque up to 257 pound-inches per 100 psi. Takes high shock pressures without danger.

EXCLUSIVE—Denison *Radially Balanced* Vane; *Cuts wear* between cam ring and vane; *Increases efficiency* with dual sealing edges; *Reduces pulsation* by radial pumping action of vanes.

SIMPLIFIES INVENTORY

No need to stock separate pumps and motors. Runs as a pump or motor without alterations. Range of capacities in each size through interchangeable cam rings.

EITHER DIRECTION—Operates efficiently as a pump or motor without change in piping. Minimum internal friction in either direction because of greatly reduced contact pressure between vanes and cam ring.

STANDARD SIZES—as a pump, Range of delivery 2.5 to 77 gallons per minute at 2000 psi.
As a motor, Horsepower output 1 to 103 hp at 2000 psi.

MORE INFORMATION—Send for Bulletin P-5-A giving complete specifications. Write . . .

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1166 Dublin Road • Columbus 16, Ohio

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

Circle 40 on Reader Service Card

Clearing Hydraulic Press—Weighing over 820,000 pounds, the gigantic Clearing press shown in this installation turns out over 150 different aircraft parts. Die cushions can be furnished straight hydraulic or hydropneumatic. Automatic tables speed feeding and unloading. During peak production, 12 men can place parts on the press at the same time.

For performance and safety... fire-resistant Pydraul in Clearing hydraulic presses

Pydraul was developed to provide industry with a fire-resistant, highly lubricative hydraulic fluid. In Pydraul-operated Clearing equipment, you have the right press for every forming operation—plus protection from the danger of hydraulic fluid fires.

Pydraul is the only fire-resistant hydraulic fluid listed with Underwriters' Laboratories. This means your plant and personnel are always protected when Pydraul is on the job.

Pydraul is economical . . . has a longer service life than most fluids, is reclaimable—return spillage to system, use again and again.

Non-corrosive Pydraul lubricates like a premium petroleum oil. You're assured of long equipment life, low maintenance.

If your hydraulic equipment is near hot metal, electrical contacts, open flame or other heat sources, you may be taking a needless fire risk. Your Monsanto representative will show you how easy and economical it is to convert to a fire-safe Pydraul system.

Write for FREE Pydraul F-9 booklet, Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. OEM-6, St. Louis 1, Mo.

Pydraul F-9—first and only hydraulic fluid listed by Underwriters' Laboratories. "In respect to fire hazard, Pydraul F-9 is rated by Underwriters' Laboratories, Inc., 2 to 3 in a class much less flammable than paraffin (Petroleum) oil, according to a schedule in which Ether is rated 100; Gasoline 90-100; Alcohol (ethyl) 60-70; Kerosene 30-40; Paraffin Oil 10-20."

Pydraul: Reg. U.S. Pat. Off.

LISTED UNDER RELEXAMINATION SERVICE UL OF UNDERWRITERS' LABORATORIES, INC.

MONSANTO

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

4-WAY VALVE
. . . with safety features

Designation: Model 2441-500 Air Valve.

Features: Valve utilizes a spool type pilot with double solenoid control. The spool is moved and the main valve shifted when one solenoid is energized. Main valve does not return to original position until the other solenoid is energized. This provides a safety factor as the valve will not reverse in case of an electrical failure. Valve has covers chained to body to prevent loss, and the solenoids are enclosed to be waterproof and air tight. Recessed pins permit manual operation without removing covers. Unit is electrically inoperative with solenoid covers removed.

Specifications: Valve is 4-way, 4-port and 4-way, 5-port, two pressures, pilot operated and double solenoid controlled. Available in ¼, ⅜, ½ and ¾-inch sizes.

Automatic Valve Company
Farmington, Michigan

Circle 160 on Reader Service Card

DOUBLE ACTING CYLINDER
. . . with non-rotating rod

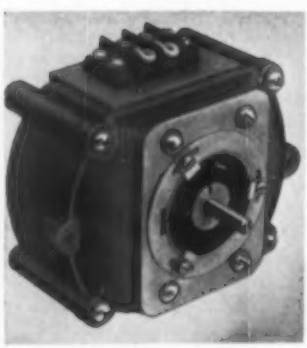
Designation: Alkon Model E Double Acting Cylinder.

Feaures: Cylinder has elliptical non-rotating piston rod designed for applications requiring accurate register of the rod without external guides. This model has an elliptical bushing which is adjustable for compliance with different rod fit requirements. This feature also compensates for eventual wear.

Specificaions: Model E is available in 1¾ and 2½ inch bores, with 3-way flush rabbet mounts as standard equipment. It is rated 250 psi air and 500 psi water or oil. Cylinder is available with all standard interchangeable mounts, in all standard strokes, cushioned or non-cushioned.

Alkon Products Corporation
Hawthorne, N. J.

Circle 161 on Reader Service Card



ROTARY SOLENOID
. . . with built-in return springs

Designation: 800 Series AC Rotary Solenoids

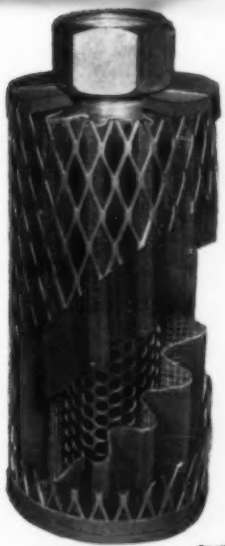
Features: Built-in return springs permit direct application of the solenoid. Remote springs and extra assemblies are eliminated. Return springs can also be used to drive loads with high starting torques and minimum impact. Use of return stroke action permits smaller solenoid sizes.

Specifications: Solenoid operates on standard voltage, 60 cycle AC, with rotary strokes up to 60-degrees and torques up to 75 in. lbs. Continuous and intermittent duty models are available. All models are totally enclosed and equipped with Class H insulation for high temperature service. A wide selection of springs is available to permit matching of solenoid to load requirements. For literature and specifications write to Dept. 77.

Leetronics, Inc.
Brooklyn, N. Y.

Circle 162 on Reader Service Card

Continued on page 58



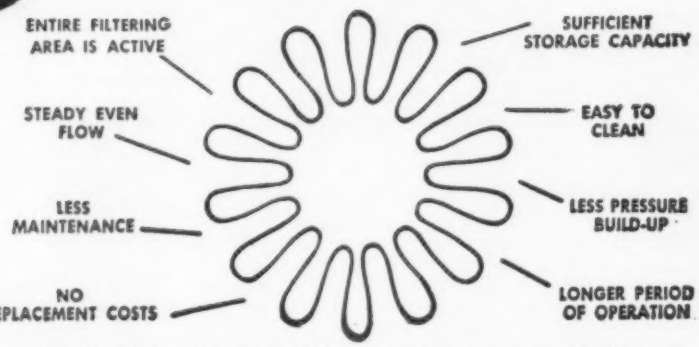
SUMP TYPE
(Cutaway)

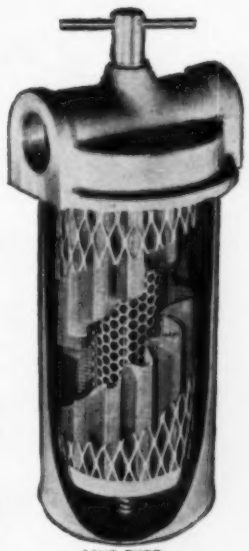
When You Need A Filter—
Get The Advantages Of
Marvel SYNCLINAL Design

It's BALANCED

For Top Performance!

LOOK FOR THESE IMPORTANT FEATURES





LINE TYPE
(Cutaway)

For All Hydraulic and Other Low Pressure Liquid Systems

In the selection of a filter to obtain maximum efficiency and quality, the most important point to consider is a specific type filter that will offer greatest *ACTIVE* filtering area with ample storage capacity for filtered out particles, rather than total filtering area alone. Over 700 Original Equipment Manufacturers install Marvel Synclinal Filters as Standard Equipment because they are designed to give this all-important balance for greatest efficiency in filtration of liquids in all hydraulic and other low pressure circulating systems. Flow of liquids is maintained at a constant, steady rate of speed produced by the pump which brings about the desired effect of a gentle, evenly distributed accumulation of filtered out particles against the entire filtering surface with less restriction of flow. Result—longer periods of productive operation at minimum maintenance down-time. If this important balance is lacking due to efforts to cram too much filtering mesh for the sake of total rather than active area, filters soon become clogged causing pressure build-up, turbulent flow and in general decreases the efficiency of operating equipment. Depend on Marvel Synclinal Filters For All Your Filtration Requirements. They meet J.I.C. Standards.

EASY MAINTENANCE

Both sump and line types may be easily disassembled, cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

Catalogs containing complete data available on request.

Write or Mail Coupon.

IMMEDIATE DELIVERY!
As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill. **PHONE: Juniper 8-6023**

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: (AH-11)

- ☐ Catalog #107—For Hydraulic Oils, Coolants, Lubricants.
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name ..... Title .....

Company .....

Address ..... State .....

WIGGINS' NEWEST!

an automatic connection

- ★ Small Space Requirement.
- ★ Low Pressure Drop
- ★ No Air Inclusion.
- ★ Any Desired Service.

Wiggins connect-O-matic Trademark COUPLING

PUSH!—It's connected Wiggins

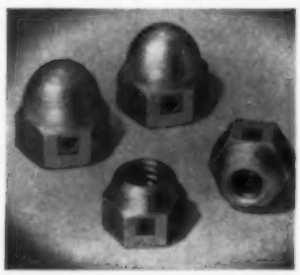
E. B. WIGGINS OIL TOOL COMPANY, INC.
3424 E. Olympic Blvd, Los Angeles 23, Calif

If it's got to connect . . . connect with WIGGINS

New Products continued

CAP NUTS
. . . with "thru-tapped" design

Features: With the new design it is possible to gain the decorative



advantage of a cap nut in applications where it is impossible to seat a regular cap nut. The self-locking principle eliminates the need for washers, speeding assembly and reducing inventory requirements. They can be re-used many times without appreciable reduction in torque. The nylon pellet imbedded in the nut projects beyond the threads and under compression sets up a counter thrust creating a strong contact. Nuts cannot shake loose under severe conditions of vibration and locking action is positive whether or not the nut is seated. They also withstand temperatures ranging from —70 to above 250 degrees F.

The Nylok Corporation
Paramus, N. J.

Circle 163 on Reader Service Card

PUSH BUTTON CONTROL
. . . is completely sealed

Designation: Gold-N-Ring Sealtight Push Button Control Switch.
Design: Plastic shields completely enclose extra large silver alloy contacts. Unit-molded main contact block assures perfect alignment and simplifies assembly. Fully guided plunger of cross head design prevents binding, and oil-resistant rubber diaphragm in operator head completely seals out oil, water and dust. Rated 600 volts AC or DC.
Features: Mounts in 1-13/64 inch diameter holes on standard mounting centers and accommodates panel thicknesses from 1/16 to ¼ inch in increments of 1/32 inch. Units and components are completely interchangeable. Different types of push button and selector operator heads can be used with single and double pole contact blocks. Brass inserts are molded into contact block to secure stationary contacts and provide maximum thread support for terminal screws, which are equipped with captive flat and lock-type washers.
Specifications: Switches can be obtained in flush-plate or box-type mountings to permit any combination of individual push button, selector or pilot light assemblies. Interchangeable collars, supplied in

three different heights, permit changing from flush to extended button by merely changing the collar. Buttons are of nonfading, glass-filled polyester resin, available in standard code colors.

The National Acme Company
Electrical Mfg. Division
Cleveland, Ohio

Circle 164 on Reader Service Card

O-RING COMPOUND
. . . meets SAE spec

Designation: Compound 77-018
Performance: Standard silicone compound has been tested and qualified under recent SAE specification AMS-3357. This specification calls for a silicone material that has lubrication oil resistance and good compression set qualities and that is suitable for temperature range of —65 to + 450 degrees F.

The Parker Appliance Co.
Cleveland, Ohio

Circle 165 on Reader Service Card

For more NEW PRODUCT reviews turn to page 128

AVAILABLE NOW

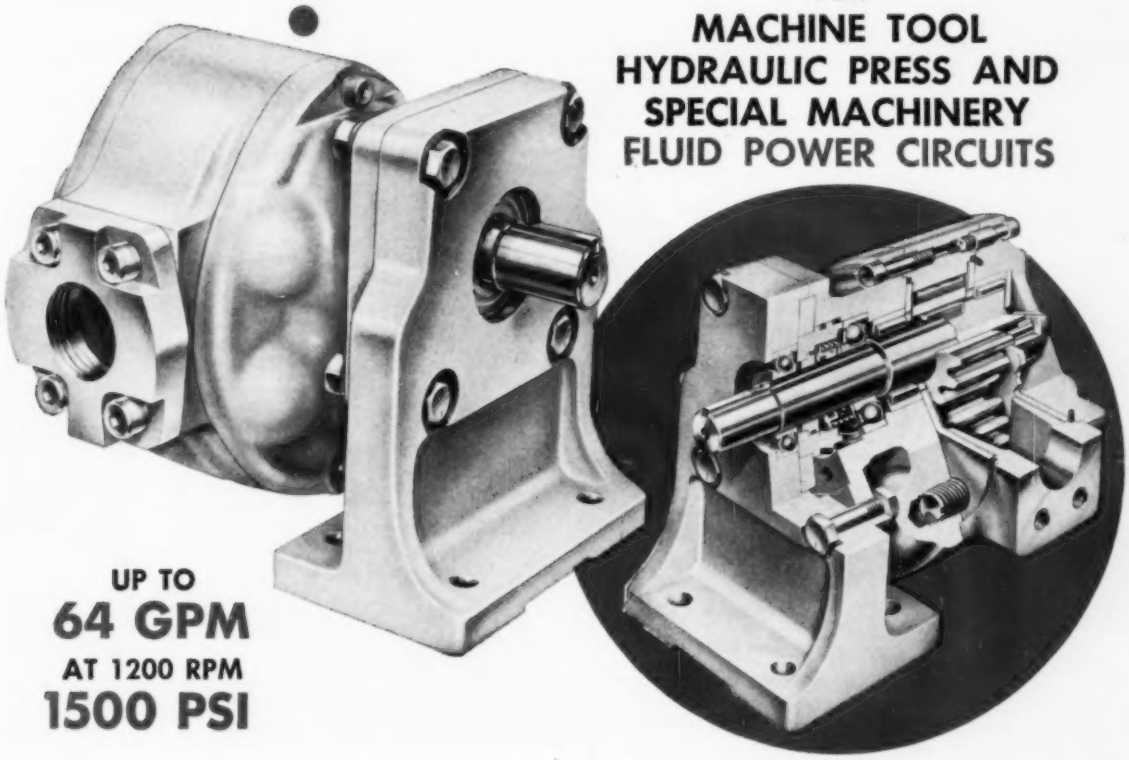
HYDRECO®

GEAR PUMPS

WITH INDUSTRIAL MOUNTINGS

FOR

MACHINE TOOL
HYDRAULIC PRESS AND
SPECIAL MACHINERY
FLUID POWER CIRCUITS



UP TO
64 GPM
AT 1200 RPM
1500 PSI

HYDRECO Gear Pumps, for years, have been specified as standard Fluid Power equipment by the *big names* in Construction, Earth Moving and Materials Handling Equipment. On these rugged-service applications HYDRECO Gear Pumps perform with outstanding dependability. They will operate under conditions of pressure, temperature, and speed unheard of on the usual industrial application. Mobile Equipment is a highly competitive field and HYDRECO Pumps have always afforded design engineers substantial economies in original equipment costs!

HYDRECO Gear Pumps are now available with standard industrial mountings, port connections and shafts. Builders and users of Machine Tools, Presses, and Industrial Equipment can now profit by the economies in these Pumps.

Make this simple test! If your hydraulic cycle is comparable to that of a tractor-shovel digging a foundation . . . a front-end loader working a gravel pit . . . or, a mammoth bulldozer crowding a bank . . . and working at full relief pressures nearly all the time—then YOU can use HYDRECO Gear Pumps to advantage! HYDRECO Gear Pumps can save YOU money NOW—in both original equipment and replacement costs.

Member NFPA

Write for performance and installation data on HYDRECO Gear Pumps with Industrial Mountings.

KALAMAZOO DIVISION
THE NEW YORK AIR BRAKE COMPANY

9004 E. MICHIGAN • KALAMAZOO • MICH.

INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

Kalamazoo Division
The New York Air Brake Company
9004-11 East Michigan, Kalamazoo, Mich.

Kindly send me full information on HYDRECO Gear Pumps with Industrial Mountings.

Name_____

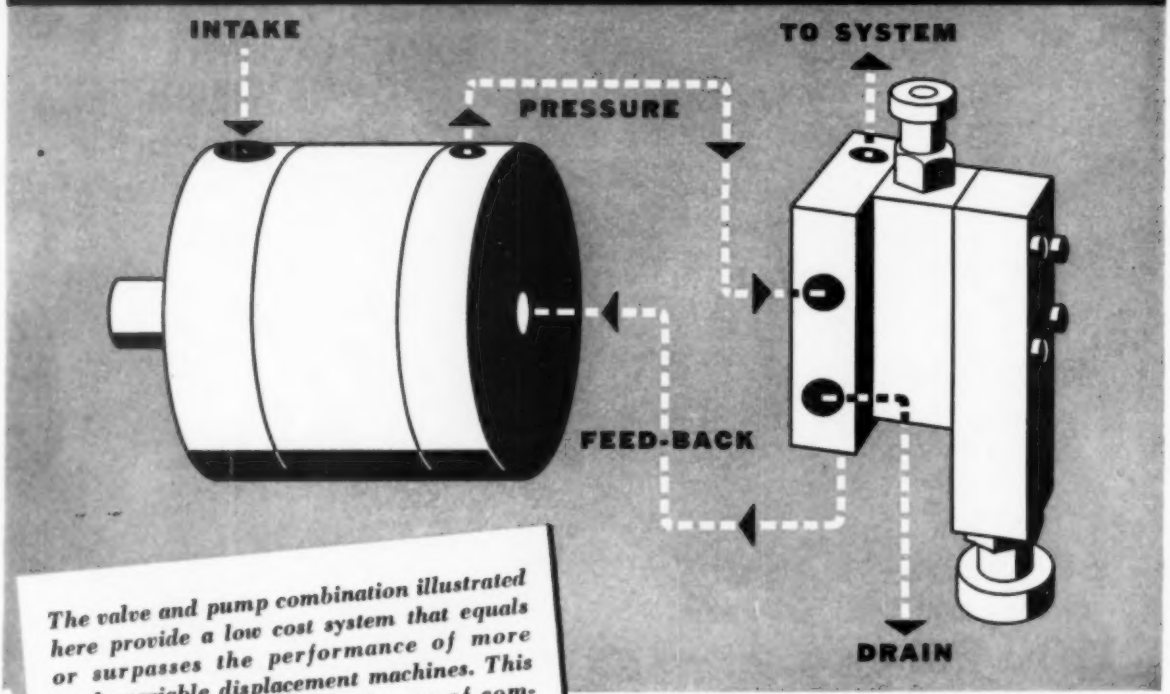
Company_____

Address_____

City_____ Zone____ State_____

a Low Cost VARIABLE DISPLACEMENT SYSTEM

Comprised of the SECO D5 Radial Piston Pump, and D5PF Valve



The valve and pump combination illustrated here provide a low cost system that equals or surpasses the performance of more costly variable displacement machines. This is accomplished through the use of completely new feed-back techniques for displacement control. (Patents Pending)

With the maximum pressure set, the flow control section of the D5PF valve adjusts the displacement of the D5 pump to maintain a selected flow, independent of load pressure and input speed—within the capacity of the pump. The flow is continuously adjustable from zero to a maximum of 5 GPM. Pressure is adjustable from 200 to ***2,000 PSI.*** Horsepower savings of as much as 85% are realized with the pressure compensation features of this system. Heating problems are negligible. The control valve can be located at the pump, or remotely, as required.

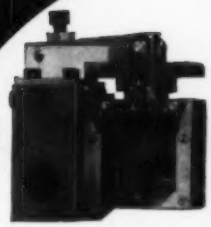
Send the Readers' Service Card for complete information.

SECO
FLUID POWER

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

CONTROLS YOU CAN depend ON

WATERMAN CONTROLS
for accuracy—dependability safety—low maintenance cost



SOLENOID VALVES

For working pressure to 3000 psi. Remote control of hydraulic systems for handling non-corrosive fluids.

LOOK TO WATERMAN

MICRONIC LINE FILTERS

Operating pressures to 3000 psi. 40 micron filtration. Replaceable elements. Available in ⅜" and ¾" NPT.

FOR THE ANSWER TO

ADJUSTABLE FLOW REGULATORS

Full range from 0.5 GPM to 20 GPM. All Waterman Flow Regulators maintain a constant rate of flow regardless of work resistance or pressure fluctuations.

YOUR FLOW CONTROL

CHECK VALVES

One piece. Leak proof. Nylon Poppet. Aluminum body. Low pressure drop.

REQUIREMENTS

Write for bulletin A of any of these products

UNLOADING VALVES

UNLOADING VALVES for system pressures to 3000 psi. Flow rates to 30 G.P.M. Fast acting, easily adjustable, maintain desired pressure settings without continuous readjustment. Hardened poppets eliminate leakage. Large passages assure maximum flow with minimum pressure loss.

WATERMAN
ENGINEERING COMPANY

725 CUSTER AVENUE • EVANSTON, ILLINOIS

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

SOLENOID VALVES . . . custom built for pneumatic and hydraulic service at pressures up to 3000 psi are manufactured by Atkomatic Valve Company, Inc. Catalog No. 200 gives a brief discussion of solenoid valves and their application and detailed information on the types available. Valves feature packless construction, stick-free bubble-tight operation, shockless closing and easy maintenance. Optional features for special valve applications include positive manual opening or throttling and check valves for flow in either direction. An added feature in this catalog is a flow chart for liquids and one for compressible fluids.

Circle 210 on Reader Service Card

O-RING HANDBOOK . . . is available from Bay Rubber & Plastics Corporation's Ohio O-Ring Division. Information is given on how to specify and use O-ring packings for pressures up to 1500 psi and their use with back-up washers for higher pressures. Catalog is 14 pages and lists 140 standard sizes available. Special compound O-rings, including Teflon and Silicone, are also covered.

Circle 211 on Reader Service Card

FLEXIBLE COUPLINGS . . . and other power transmission equipment is described in a brochure describing products manufactured by Lovejoy Flexible Coupling Co. The literature covers the company's line of flexible couplings, variable-speed pulleys and transmissions, universal joints, and motor bases. Operating data, horsepower ratings, sizes, and types are given for each item. The flexible couplings are of the non-lubricated type. The light-duty types for service to 40 hp use spider-type cushions. Special types feature radial removability, direct connection to an engine flywheel, brake drum flange, and units bored for special bushings. The variable-speed pulleys provide speed ratios to 8:1 with hp ratings from ¼ to 15 at 1750 rpm. The variable-speed transmissions are lever or hand-wheel controlled for speed ratios to 10:1.

Circle 212 on Reader Service Card

ELECTRIC MOTORS . . . repulsion-induction (buried bar) type are manufactured by Peerless Electric Company's Motor Division. Their new Engineering Data Bulletin SDA-163-A gives details and specifications. Motors are single phase and produced in sizes from 3/4 to 7-1/2 HP, 1150 to 1750 RPM, 115/230 volts. Drip-proof, splash-proof and totally enclosed models are available.

Circle 213 on Reader Service Card

PRESSURE GAUGES . . . for almost all types of air and hydraulic applications are described in Catalog No. 64 published by United States Gauge Division, American Machine and Metals, Inc. Gauges shown are recognized as standard for all industrial applications and represent one of the most complete lines in this field. There are 68 pages of information on presure, temperature, flow and level measuring instruments including special quality models, hydraulic pressure compound, duplex, gearless and laboratory test gauges. Complete specifications are given for each unit, with illustrations and sketches.

Circle 214 on Reader Service Card

TEST STANDS . . . for use in laboratories or in production to calibrate liquid flowmeters are manufactured by George L. Nankervis Company's Commercial Research Division. In Catalog 4-TS complete description and specifications are given for the 300 series and Type 416 Universal Fuel Nozzle Test Stand. The Flowmeter units are precision instruments for calibrating all types of liquid flowmeters by direct weight and are semi-automatic, requiring only one operator. Fuel nozzle units are designed for rapid and accurate testing of gas turbine fuel nozzles in laboratories or production. Complete information is given on the operation of the units, special features and control equipment.

Circle 215 on Reader Service Card

AIR MOTORS . . . double acting with sealed-in lubrication are described in the new 40-page catalog of Lehigh, Inc. Air Control Division. Detailed information is also included on air cylinders, small air valves, air control equipment and drill press feed. Complete specifications are given along with illustrations, cutaways, schematic drawings and charts.

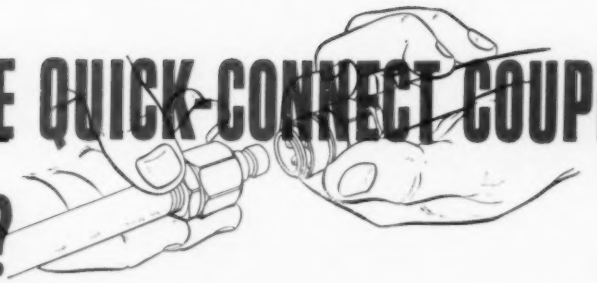
Circle 216 on Reader Service Card

DIAGNOSING COMPRESSOR TROUBLES . . . A new booklet to help locate and correct common troubles in air-cooled and water-cooled compressors has been released by Worthington Corp. A cartoon sequence gives a full description of compressor troubles such as failure to deliver air, overheating, insufficient pressure, vibration, and overloading.

Circle 217 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 144

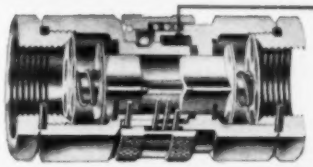
WHICH SNAP-TITE QUICK-CONNECT COUPLING IS BEST FOR YOU?



SNAP-TITE "H" COUPLING . . . . FOR HIGH PRESSURE APPLICATIONS

FOR HYDRAULIC OR AIR

"H" Coupling for high strength, higher efficiency, high-resistance to heavy line surge. Sizes: ⅛" thru 12". Bulletin No. 240

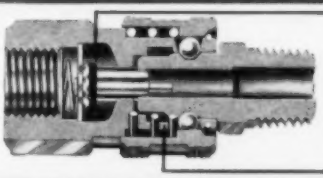


Exclusive U-packer gives a positive seal without compression set because of rubber distortion. Line pressure inside the U-packer keeps it open and forced against its metal backing—the higher the pressure, the tighter the seal.

SNAP-TITE HI-FLOW COUPLING . . . FOR LOW PRESSURE APPLICATIONS

FOR AIR AND FLUIDS UP TO 150 p.s.i.

Hi-Flow is recommended to connect small air tools to plant air system, and for low pressure fluid transfer in small lines. Sizes: ⅛" thru ¾". Bulletin No. 230

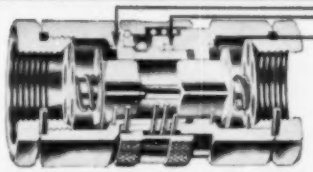


Bonded valve washer
(pat. pending on valve construction)

Exclusive U-packer

SNAP-TITE "HK" COUPLING . . . FOR HARD TO HANDLE FLUIDS

FOR FUMING ACIDS, ALKALIES, SOLVENTS, AND HIGH PRESSURE STEAM . . . "HK" is the only coupling now on the market for fluid temperatures from —100° F to +500° F . . . and for live steam up to 460° F. Its seals are made of Teflon for which there is no known solvent. Sizes: ½" thru 3". Bulletin No. 270



Teflon Valve Seal

Teflon Nipple Seal

Teflon Valve Seal

SNAP-TITE NO-SPILL COUPLING . . . FOR MINIMUM AIR INCLUSION

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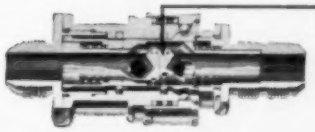

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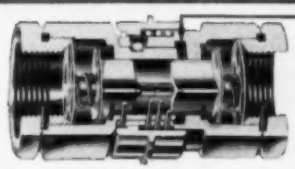

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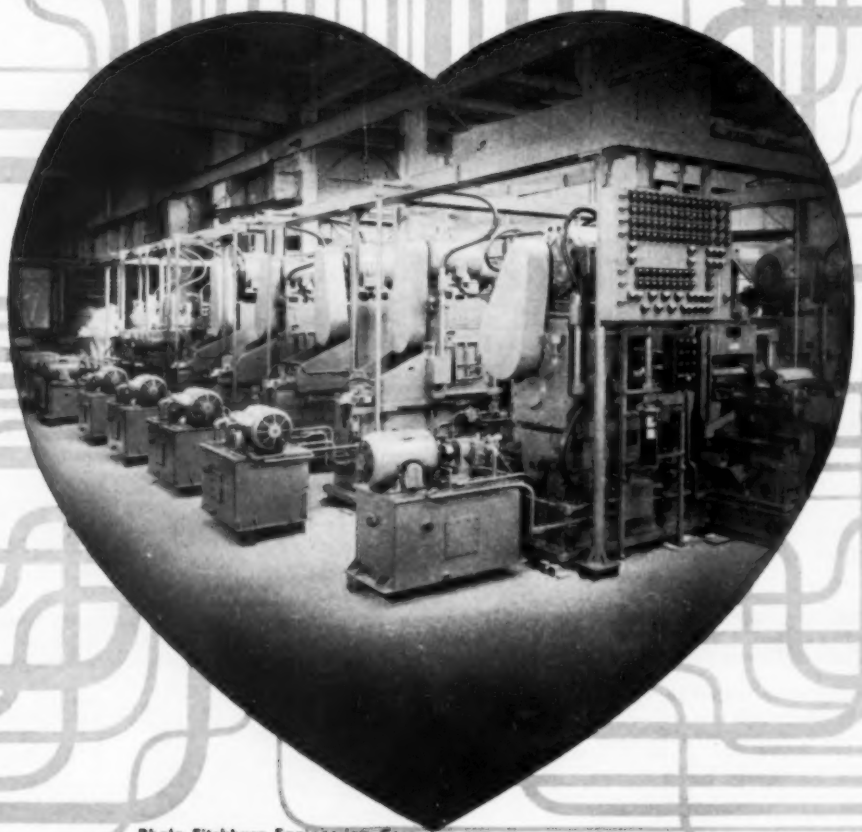

Photo Fitchburg Engineering Corp., Fitchburg, Mass.

This mechanical giant was designed and built by Fitchburg Engineering Corporation. It is a 23-station transfer machine for milling, boring, drilling and reaming automatic transmission cases for new cars. Its "blood vessels" are many sizes of low carbon steel SAE hydraulic tubing by Superior, carrying pressures up to 1000 psi throughout the system. The breakdown of just one "blood vessel" could stop not only the machine but the entire production line—a very costly mischance. Superior tubing was chosen because it provides a dependable, leakproof hydraulic system.

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Circle 101 →

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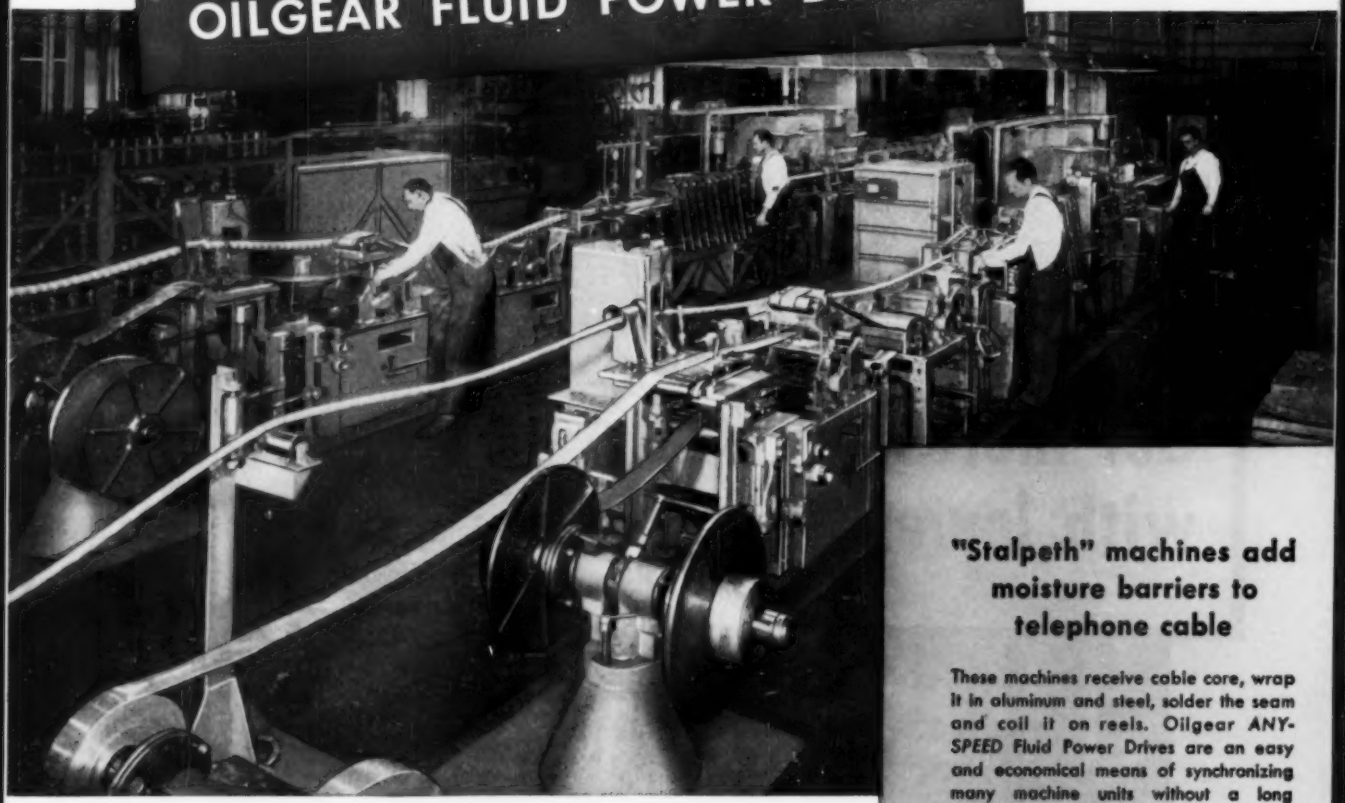
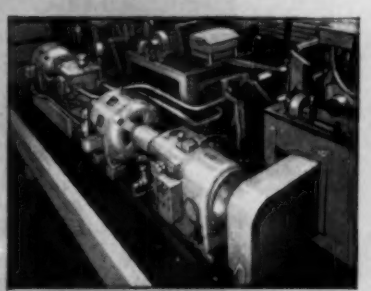
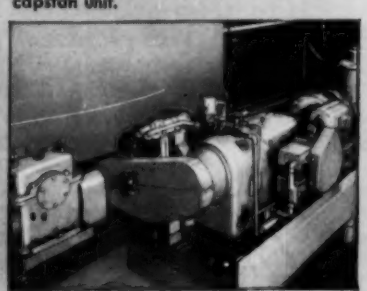


"Stalpeth" machines add moisture barriers to telephone cable

These machines receive cable core, wrap it in aluminum and steel, solder the seam and coil it on reels. Oilgear *ANY-SPEED* Fluid Power Drives are an easy and economical means of synchronizing many machine units without a long lineshaft.



These Oilgear *ANY-SPEED* units drive the aluminum and steel corrugator units in perfect unison with the governing capstan unit.



The Oilgear *ANY-SPEED* capstan drive. Not shown here is another Oilgear unit driving the cable winding reels.

Solving the problem of close synchronization of driven members

As machines become more and more complex, combining more and more functions into a single unit, the problem of driving these machines successfully becomes more difficult.

This problem confronted Western Electric Company engineers in designing what they call their "Stalpeth" machines, two of which are shown above. These machines combine corrugating of steel and aluminum strips, forming them around the cable core, soldering the seam and then winding the assembly on reels at the far end. All of the members of the machine must be synchronized to the speed of the capstan unit. Going by their experience with other somewhat similar machines, Western Electric engineers again turned to Oilgear *"Any-Speed"* Fluid Power Drives, to solve what is really a complex problem ordinarily. Oilgear units provided an easy and economical means of synchronizing many machine components.

Oilgear *Any-Speed* Fluid Power Drives and transmissions *do* offer many machine design advantages including ease of control and synchronization of driven members, steplessly variable speed, fundamentally simple circuits, and long, trouble-free life. Write for Oilgear drive bulletins. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.

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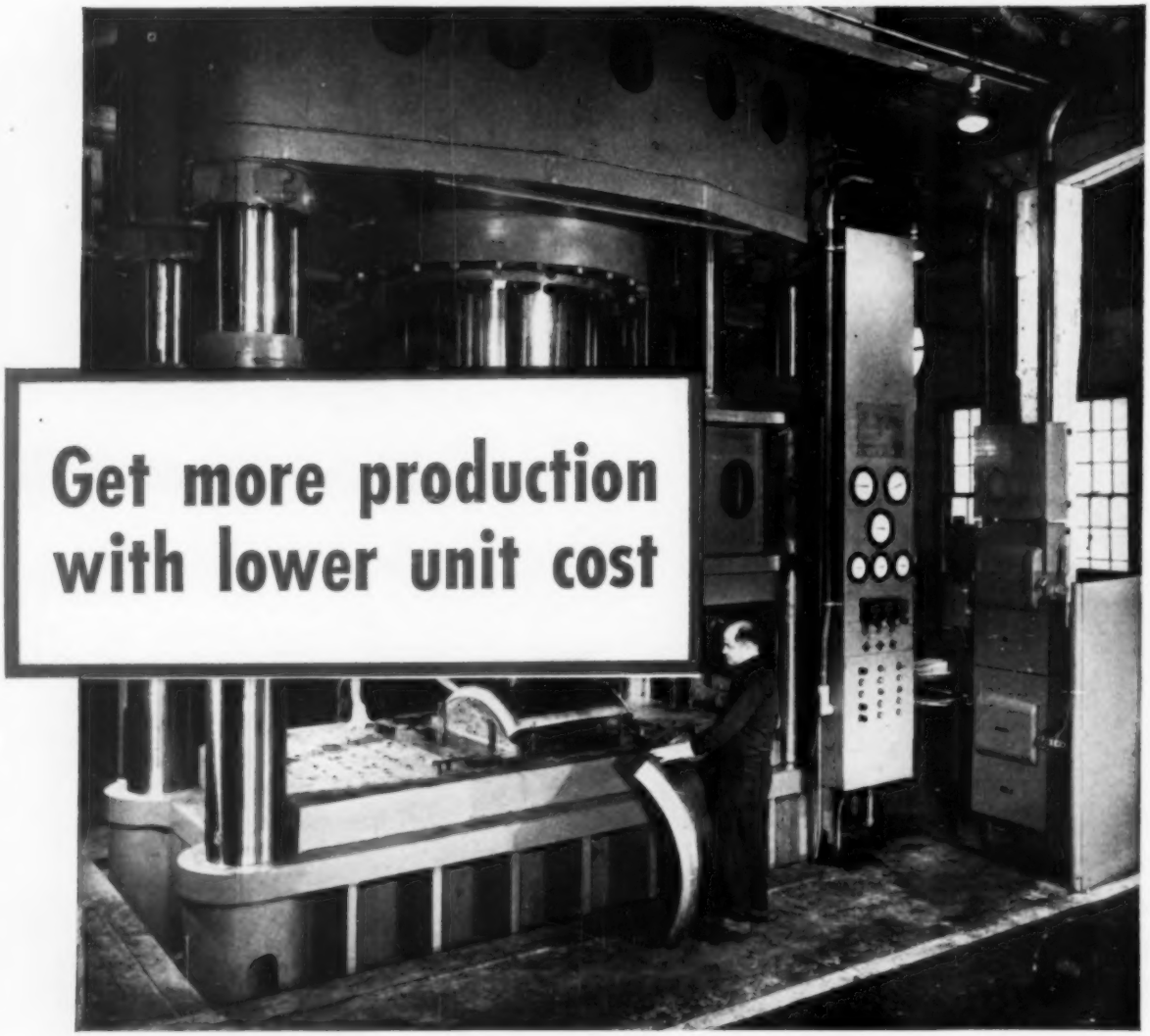

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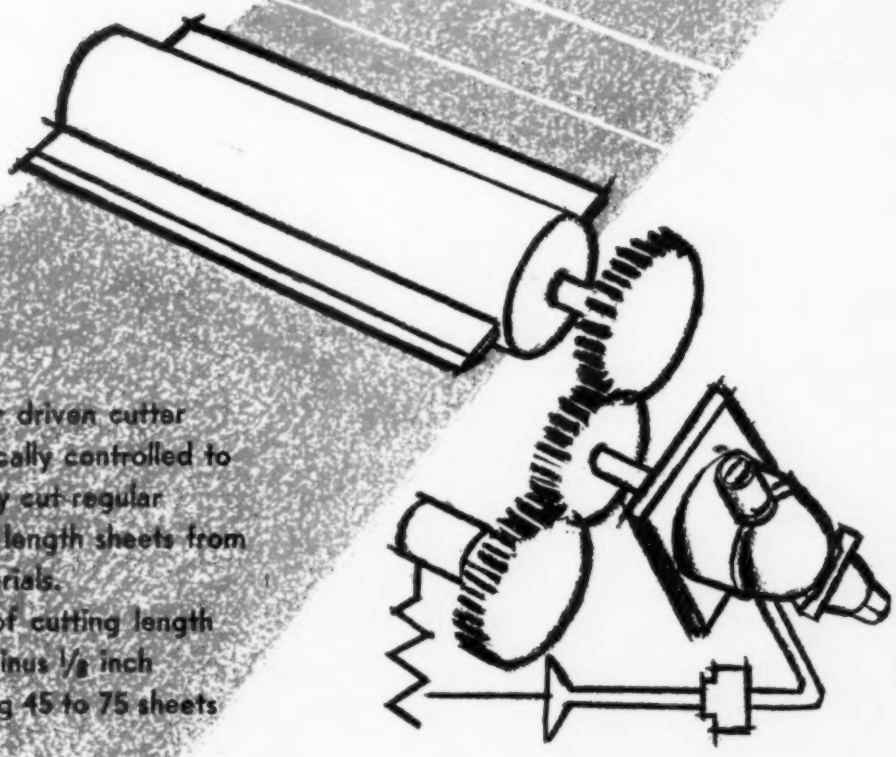
ELECTRONIC POSITION SERVO

... controls hydraulically driven web cutter



Fluid motor driven cutter is electronically controlled to continuously cut regular or variable length sheets from rolled materials. Accuracy of cutting length is plus or minus 1/8 inch while cutting 45 to 75 sheets per minute.

● By Joseph Reed

MANY industrial processes require that strips or rolls of materials such as cloth, paper, plastics or thin metals be cut into sheets of regular or variable lengths. In the textile industry, where variable lengths are a common occurence, continuous strips of woven materials are known as webs. Mechanical devices for cutting webs into regular lengths have been in use for many years, but variable lengths present time-consuming problems. Production efficiency drops considerably, when mechanical devices must be reset or when unusual lengths require hand cutting; and top efficiency is of prime importance in this highly competitive field.

American Machine & Foundry Company engineers have developed an automatic, electro-hydraulic web-cutting system. This system drives and positions a rotating cutter, for an application which requires instantaneous cutting on random-spaced registration marks varying in spacing from a minimum of 18 inches to a maximum of 24 inches on webs and moving at the rate of more than 50 yards per minute. While this web cutting system was designed for special requirements, it could be made applicable to many other situations with few modifications.

JOSEPH REED, *was Project Engineer with, American Machine & Foundry Co., Greenwich Laboratories, Greenwich, Connecticut. He is now on the staff of General Precision Laboratories.*

ELECTRONIC POSITION SERVO

AMF engineers utilized a cylindrical cutter with a circumference equal to twice the nominal spacing between registration marks applied to the textile webbing. The axis of the cutter parallels the line of cut across the web. In operation, the web is passed

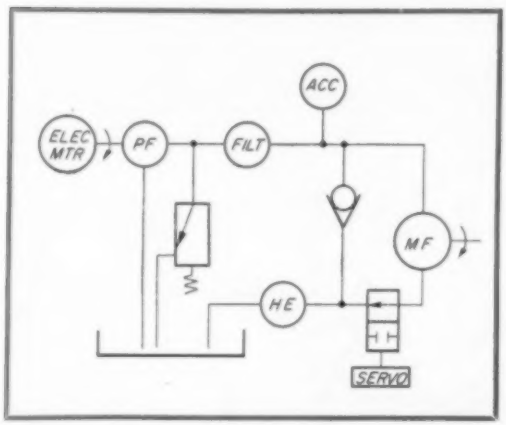


FIG. 1 Hydraulic drive circuit is servo controlled.

between the cutter and an anvil roll. Two knives fixed to opposite sides of the cylindrical cutter cut the web instantaneously when they make contact with the anvil roll. Accuracy of cutting length is kept to plus or minus $\frac{1}{8}$ inch, so that cuts are made at the centers of registration marks. The average rate of cutting is between 45 and 75 sheets per minute. The lowest possible accurate speed of operation is 6 sheets per minute.

A major specification implied in all present-day industrial equipment is reliability and ease of maintenance. A judicious combination of hydraulics and electronics was, therefore, used in this design to produce a reliable, accurate, yet simple piece of equipment. The web cutter positioning mechanism is an electro-hydraulic, rotary position servomechanism. The position indication and signal system are electronic. The knife drive and correction system is hydraulic. The drive system is illustrated in Figure 1. A photograph of the experimental system is shown in Figure 2.

A fixed displacement, axial-piston-type pump is capable of 6.7 gpm at a system operating pressure of 1500 psi. Pressure is maintained at a near-constant value by means of a fast-acting, pilot-operated relief valve. A small accumulator designed to accommodate peak demand aids in maintaining pressure. The driver motor is also of the simple, axial-piston, fixed displacement type. It is rated at 3000 psig maximum and 0.6 of a cubic inch displacement per revolution. The cutter is geared to the motor so that 45 sheets per minute (90 cuts per minute) require a motor speed of 1280 rpm.

The relatively small power requirement dictates the use of simple, inexpensive components even at the expense of efficiency. As a consequence maintenance is made simpler.

The entire hydraulic power package is mounted as a unit. The pump, relief valve, electric motor, heat exchanger and strainer are all mounted either on or in the reservoir. The electric motor is rated at $7\frac{1}{2}$ hp, which is considerably beyond the normal power requirement, so that a long, trouble-free life can be expected. A suction filter is provided on the intake, and a high-pressure in-line filter is used on the exhaust side. The oil used is of the MIL-05606 type. Hydraulic oil temperature is maintained at about 75°F by means of an oil-to-water heat exchanger (oil cooler).

A proportional vale controls the speed of the hydraulic motor. The valve is of the two-stage, torque-motor type, rated at 8.5 gpm full open, with 1000 psi drop. This valve was originally a four-way type, but it was modified so that in the non-actuated position it is partially open, and in the reverse position it is completely shut. This permits operation of the hydraulic motor in one direction only, which is necessary in this case because the web can not be reversed. With normal operation at 1280 rpm (45 sheets per minute), the valve is held partially open continuously at the normal flow of 3.3 gpm, with 1175 psig across it.

The valve characteristic is shown in Graph I. It will be noted that the characteristic is almost

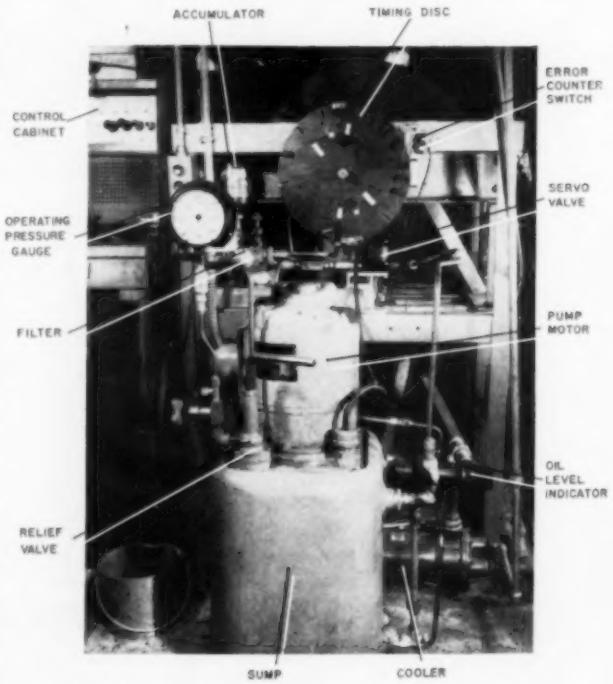


FIG. 2. Power unit in the experimental set-up.

linear, so that an increase or decrease in differential torque motor current will cause a proportional increase or decrease in oil flow and therefore in motor speed. This system characteristic is used to produce a speed regulator with many of the characteristics of a position servo system.

CONTROL SYSTEMS

Referring to Figures 4a and 4b, basically the system is a modified speed regulator. Essentially, the control system consists of two tachometers and an electronic amplifier. One tachometer is fixed to a roller which operates from the web speed. Actually, it is actuated by the anvil roll itself. The second tachometer is geared directly to the hydraulic motor. The gear ratios through which these tachometers are operated are so arranged that the circumferential speed of the cutter roll and the linear speed of the web are matched exactly when both tachometers are operating at the same speed. The electric potential created by these tachometer generators is applied through balancing resistors to the amplifier.

The potential created by a tachometer generator is proportional to velocity, so that the voltage into the amplifier is actually proportional to the difference in speed between the knife roller tachometer and the web roll tachometer. This voltage is amplified in a simple two-stage direct current amplifier and applied to the proportional valve. An electric bias is applied to the valve so that with no signal present the amplifier holds the valve closed. If the gain of the amplifier is large enough, the valve will open to a position such that the difference in speed between the web and the knife roller will be held to a very small value.

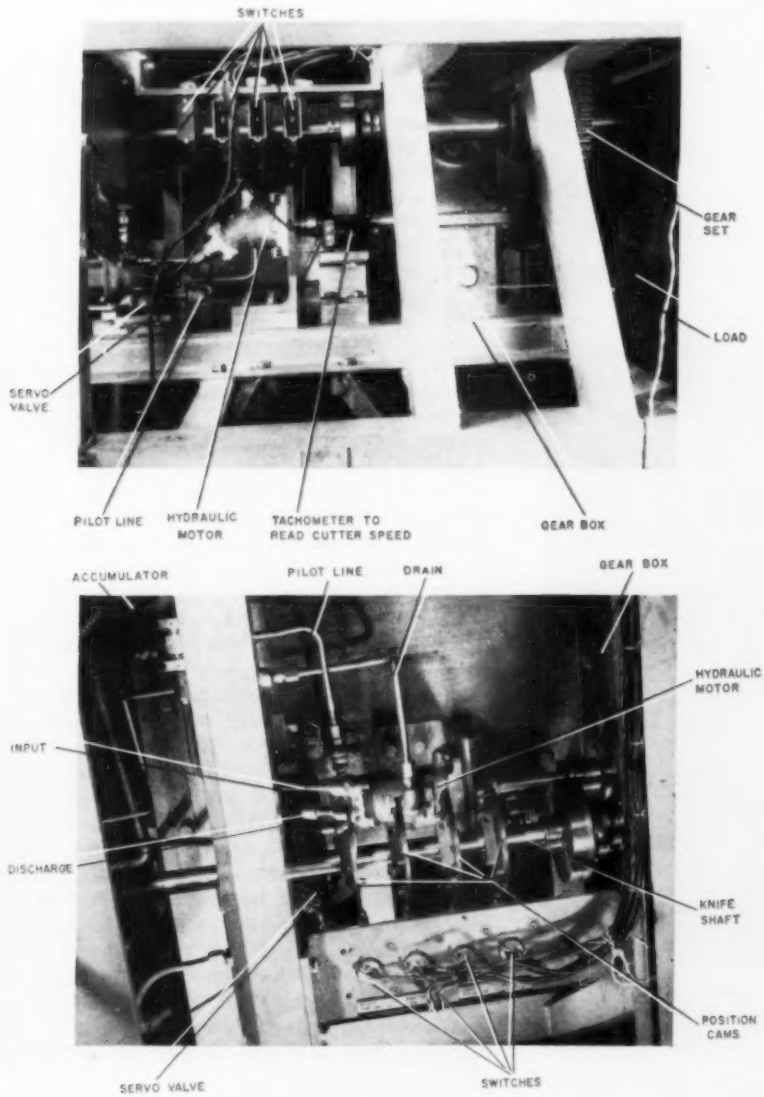


FIG. 3. Top and side views of the experimental model shows the components used to control and power the web cutter.

ELECTRONIC POSITION SERVO

This action will take place over a wide range of web speeds. The particular cutter being discussed has been operated over a range of 6 rpm to 150 rpm knife roll speed with very little change in accuracy.

At this point a modification to the velocity servo was introduced. Refer to Figures 5a and 5b.

In Figure 5a the error voltage introduced to the electronic amplifier is the difference in tachometer voltages. For identical tachometers the difference represents speed, thus:

$$Ve = K_{tach} [\theta'_w - \theta'_k] \quad \text{.....(1)}$$

Ve = error voltage

K_{tach} = tachometer constant (volts/rps)

θ'_w and θ'_k = web and knife velocities (rps)

In Figure 5b, however, the error voltage introduced to the electronic amplifier is

$$Ve = K_{tach} [\theta'_w - \theta'_k] [1 - e^{-t/RC}] \quad \text{.....(2)}$$

$$Ve = \frac{K_{tach} [\theta'_w - \theta'_k]}{RC} t \quad \text{.....(2a)}$$

t = time (seconds)

R = balancing resistor (ohms)

C = capacitance in farads

From equation (2), the error voltage is approximately proportional to the time integral of the difference in velocities. In other words it is proportional to the difference in *position* between the knife and web tachometers. The system therefore has the characteristic of a position servo.

This error voltage is accurate for small values of time (i.e. t is very much smaller than RC). This only means that the correction time of the servo must be small. In other words the servo crossover frequency Wc must be relatively high with respect to the integrating time constant RC. The actual values used were:

$RC = .25 \times 10^6 \times 40 \times 10^{-6}$
$= 10$ seconds

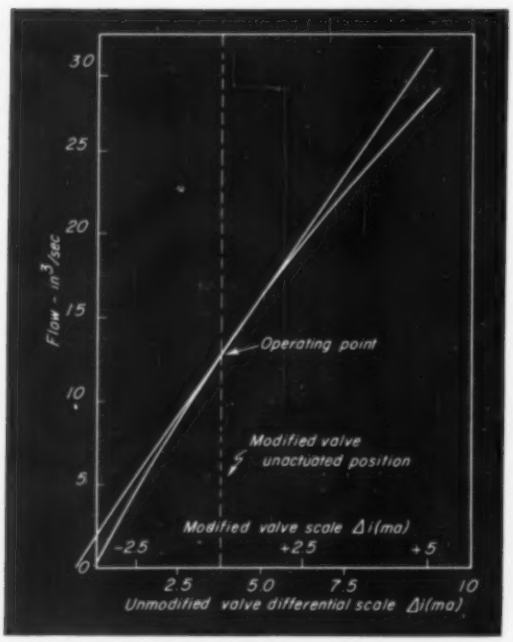
W_c for servo ≥ 6 radians/sec

$1/RC = 1/10$ radian/sec (i.e., much lower than w_c)

This demonstrates that the system is actually a fairly accurate position servomechanism. The knife roll and the anvil roll will tend to remain at the same relative position at which they started. They will, therefore, operate at the same speed.

The purpose of such a system is that the knife and web speeds are held very closely identical to prevent web damage during shearing. When the correction was limited to a small velocity difference, there was still an error in velocity. By correcting *to a position* difference it is possible practically to minimize the velocity error. Theoretically, of course, there should be no difference in velocity. Actually since the integration is not perfect there is still a very small velocity difference present.

The major advantage of this system is the ability to correct for variable lengths of sheets.



GRAPH 1 Characteristic of the servo valve shows oil flow regulation with change in torque motor current. Valve was modified so that it is partially open in the unactuated position.

VARIABLE LENGTH CUTTING

The system is required to sense the registration marks on the material and correct the position of the knife roll so that the cuts are made precisely on the registration marks. To do this, a further modification of the control system was made.

In this application the length of sheet to be cut varies over the range of 18 to 24 inches and the distance between registration marks varies accordingly. It is therefore necessary to measure the distance between registration marks on the web and dispatch the knife roll for each cut.

The distance is measured by comparing the position of the knife roll and the web registration mark before each cut. The registration mark is sensed by a photocell device which reverses the position of a relay (K_1). Knife roll position is sensed by a cam-actuated relay (K_2). This relay is reversed when the cam, which is fixed to the knife roll, reaches a predetermined position. Both relays are reset by a cam on the knife roll which is actuated immediately after the knife has passed the cutting position. Correction of the knife roll position is an inherent part of the position measuring device. Here is how this automatic correction is obtained:

Amplifier output and input polarities are so arranged as to open the valve (increase knife roll speed) on the signal from the web tachometer. Conversely the valve closes (reduces knife roll speed) on the signal from the knife tachometer.

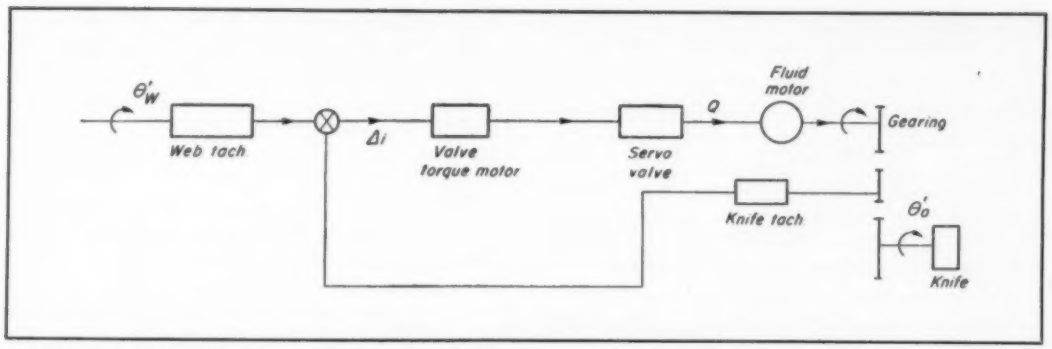
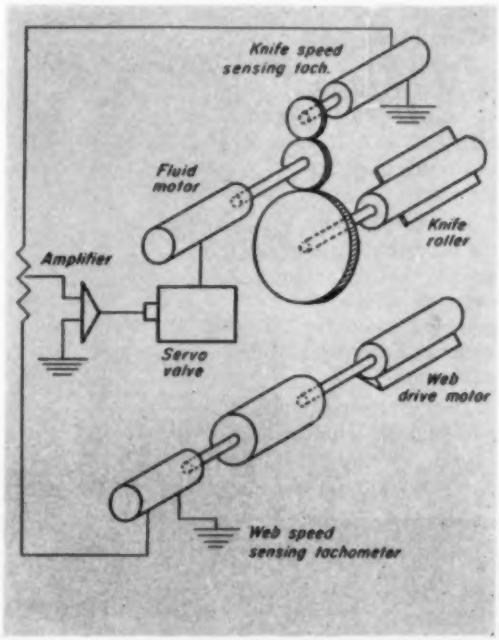


FIG. 4. (a). Block diagram represents the speed control servo circuit.

FIG. 4 (b). Schematic of knife speed regulating system.



Reference to Figure 6 shows that should the knife roll cam actuate K_2 before K_1 is actuated, then the knife tachometer signal will be "shorted" through "r" so that only the web tachometer signal will be present. The knife will then be speeded up. Conversely, should the photocell actuate K_1 before K_2 is actuated, the signal from the web tachometer will be absent and the knife roll will be slowed down. When both relays are either unactuated or actuated, both signals will be present. The knife roll will then operate in synchronism with the web.

The photocell sensing device is located 18 inches before the cut point (minimum length sheet). The cam on the knife roll is also set to actuate at 18 inches before the knife meets the anvil rod. The system, then operates as follows:

(1) Knife and Web Relays Actuate Together.

No change occurs in knife roll speed and the knife meets the web at the anvil roll operating at the proper speed for cutting.

(2) The Knife Lags the Proper Position.

The web relay is then actuated and the knife tends to speed up.

Meanwhile, however, the web tachometer charges the capacitor until the knife relay actuates. The net charge on the capacitor as mentioned above represents the error in position between the knife and web. The servo attempts to reduce the error voltage (which is the capacitor charge) to a very small value by speeding up the knife roll to discharge the capacitor. Since the knife tachometer charge represents the *distance* the knife has moved, the knife synchronizes its position with the registration mark. The knife tachometer can only operate after K_2 in Figure 6 is actuated, but this introduces no error if the servo transient response is fast enough, since the change recorded is the net difference in position between the knife actuating cam and the photocell trigger at the time that *both* have been reversed. The only error is leakage from the capacitor. Furthermore, the knife roll speed is proportional to the capacitor voltage and the knife roll slows down as the charge is decreased. Rapid correction is also necessary because the knife roll speed must be synchronized with the web speed by the time the cut is to be made.

3. The Knife Leads the Proper Position.

The knife roll cam actuates the knife relay first. The knife tachometer tends to slow the knife down, while it places a charge on the capacitor. Again the difference in position at the instant when both tachometers are again operative is recorded as charge on the capacitor. The servo reduces the charge, since this is its error voltage by holding the knife roll to the slower speed until the web tachometer has discharged the capacitor.

Both relays are restored to normal by momentarily removing the "holding" current with a cam-

actuated switch on the knife roll which operates immediately after the cutter has reached the cutting position.

All the devices described are rugged, simple, reliable pieces of equipment. Alignment is relatively simple, being either an electrical or a mechanical measurement of position for cam setting purposes.

The choice of a valve-actuated hydraulic drive permitted the construction of a simple system with rapid correction. The only servo stabilization required beyond the normal replenishing valve across the motor is a simple electrical lag lead network before the amplifier.

The system was calculated for velocity coefficients of 350 degrees/sec/degree and 500 degrees/sec/degree and bandwidths varying from between 5 cps to 7 cps. These represent the extremes within which this particular system could be operated with stability.

In actual practice it was found better to reduce the bandwidth to somewhat above 1.5 cps and the velocity coefficient to about 200 degrees/sec/degree so as to achieve the extreme system stability required if amplifier and electronic maintenance needs in a factory installation are to be held to a minimum.

The electronic equipment consists of a two-stage, push-pull DC amplifier with provisions for inserting 400 cycle-per-second voltage from an integral oscillator for dither to the valve. It was found that relatively small amounts of dither were required.

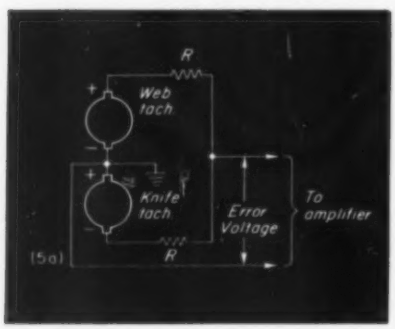
The relays are fast acting units which are actually thyratron operated. Thyratron operation is a refinement which may not be needed in slower acting systems.

The control panel contains a "self checking" device consisting of a calibrated meter and switch. By simply turning the switch through its various positions and noting the meter position against a fixed mark, it is possible to check various parts of the circuit against the standard.

Future applications of this system are expected to incorporate oil level, operating pressure and calibrating signals into the control panel in the same manner.

The experimental model shown in the photographs incorporated a timing disc and stroboscopic lamp for cam setting purposes, as well as an error indicator to determine the accuracy of cut. It is interesting to note that when the breadboard unit was operated during development runs for the entire period of a normal factory day there was only one error in cutting at startup and one at shutdown. Reports on pre-production models, now in use for nearly a year, indicate similar levels of performance and accuracy. ▼▼▼

The electro-hydraulic webcutter was designed under the direction of Leo Strauss, and with the assistance of R. Bulkalder and R. Eckerson.



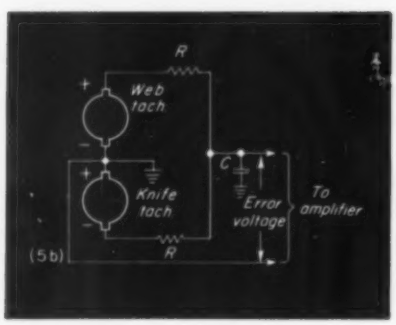
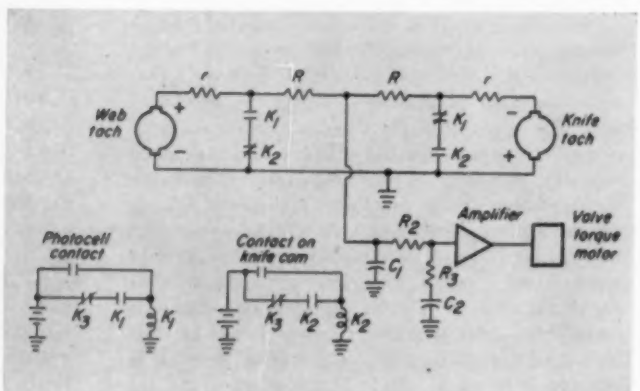


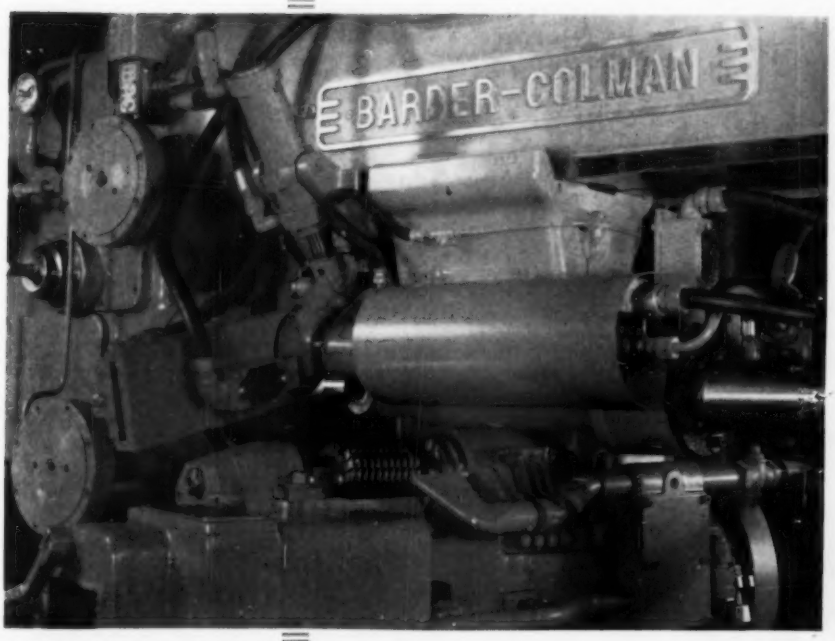
FIG. 5. (a). Unmodified tachometer circuit.

FIG. 5 (b). Modified tachometer circuit

FIG. 6. This complete control system shows electrical network used to correct position of the knife roll so that cuts are made precisely on registration marks. K_1 is actuated by the web. K_2 is actuated by the knife cam. Both K_1 and K_2 are held after actuation until released immediately after cut by a cam on the knife roll. Contacts K_3 are actuated by a second cam on the knife roll.



Intergration of automatic loading and unloading devices on machine tools is getting greater attention from users. The potential of increased production and lower costs which can be had by adapting existing machines is a tremendous incentive. Here's how Barber-Colman engineers have applied pneumatic power to achieve automatic parts handling.



UNLOADING magazine is on this side of the machine. In this photo, the work holding arbor is removed; the cutter is seen below the arbor position.

AIR CYLINDERS ACTUATE MECHANISMS

. . . to automate gear hobbers

INGENUITY in developing handling and unloading devices and in laying out the automatic controls is illustrated in the design of an automated gear hobber.

Essentially, the design problem which confronted the engineers at Barber-Colman Company was to automate the loading and unloading of a standard gear hobber. The need for automatic parts handling was presented by a customer whose production requirements for a gear made automation economically attractive.

In the first stages of development, all motions involved in loading and unloading were carefully studied. Handling mechanisms were sketched and preliminary layouts were made to determine allowable space. Accomplishing all the necessary motions

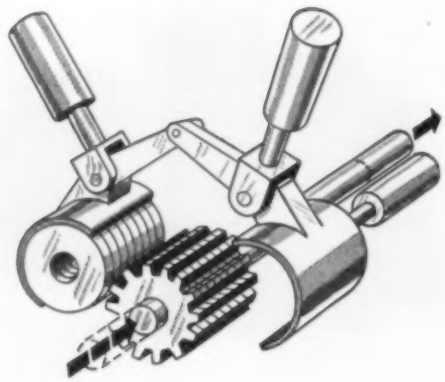
without interference between machine members required careful layout.

Pneumatics was selected as the power source for all motions early in the design planning. Necessary speeds and loads are easily handled by air cylinders of sufficiently small diameter to simplify the layout and minimize problems of interference. Air pressure of less than 80 psi is used. Pneumatics is also used on the basic machine to clamp the work slide and to power the work slide with an air-oil cylinder.

Electrical control of all solenoid actuated air valves requires seventeen limit switches. Most of the limit switches are tripped by motion of the various mechanisms or workpieces. Four of the limit switches are tripped by a pulsator cam which is driven at about 2 rpm through gearing by a fractional hp motor. These switches, motor and cam are located in the electrical control panel along with all control relays.

Significance of this design is the application of standard actuating and control components to do an automation job on a standard machine tool. The ideas represented by the sketches of the handling mechanisms can be readily applied to many arbor mounted workpieces.

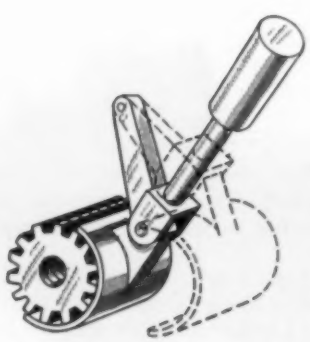
1 *Removing Arbor From Finished Gears*



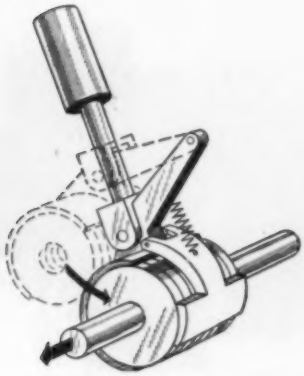
On this particular setup, eight gear blanks are hobbed in each cycle. At the completion of hobbing the arbor must be removed from the gears to permit unloading. Arbor removal and insertion is a straight push-pull motion powered by a 2-½ inch bore, 9-⅛ inch stroke air cylinder. The piston rod of the cylinder is threaded into a fitting in the end of the work arbor. This fitting is made with a ball to give a "floating" connection. The arbor is, of course, accurately guided throughout the stroke. Engagement of the arbor with the spindle drive is with a spring loaded clutch mechanism which is engaged or released by an 8 in dia 1 in stroke rotating air cylinder mounted on the work spindle. Air actuated swinging arms are ready to pick up the finished gears and replace them with blanks.

2 *Unload Finished Gears To Magazine Position*

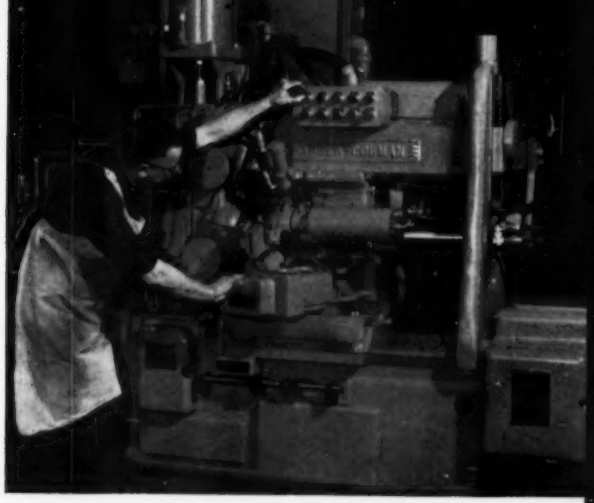
A trunnion mounted cylinder having a 1-½ inch bore and a 2-¾ inch stroke swings the unloading arm into position around the finished gears while the arbor is being retracted. Like all cylinders in this parts handling circuit, the unloading arm is controlled by a two position, 4-way pilot operated solenoid controlled valve. This entire handling package is gib mounted to the overarm of the hobber. Having picked up the finished gears, the unloading arm will now swing back to the unload magazine and trip a limit switch to initiate the next motion.



3 Load Blanks Into Arbor Position



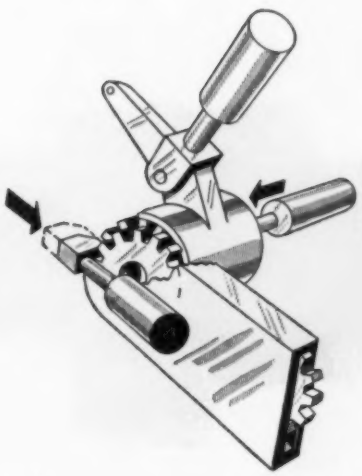
The loading arm cylinder is identical to the unloading arm cylinder. When the arbor area has been cleared of finished gears, the loading arm swings 8 blanks into place and the arbor cylinder extends to insert the arbor. The load arm swings back empty to the load magazine ready to pick up blanks for the next cycle.



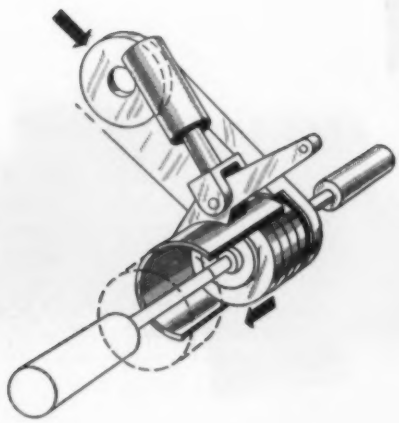
GEAR HOBBER with the automatic air powered handling devices is being set-up for operation.

4 Eject Finished Gears Into Unload Magazine

While the blanks on the arbor are being hobbed, finished gears are being unloaded from the arm into the magazine, and on the other side of the arbor new blanks move from a magazine into the loading arm. Two cylinders are used to eject the blanks. Each cylinder must reciprocate eight times to clear the unloading arm. To overcome the sticking of gears caused by an oil film, a 1 inch bore cylinder wipes each ejected gear into the unloading magazine from which the gears roll by gravity.



5 Load Blanks Into Loading Arm From Magazine



To load the blanks into the arm, the load cylinder reciprocates eight times. Each time, it moves forward a blank is pushed from the gravity fed magazine to the arm. In this case the blanks are pushed up against a small 1 inch bore backup cylinder which is on the same centerline as the loading cylinder. The eight pulses of both the loading and unloading cylinder are timed by limit switches tripped by a pulsator cam which is driven by a fractional hp motor at 2 rpm. When the loading arm is full, the backup cylinder is fully retracted to trip a limit switch which prevents further action of the loading cylinder.

SPEED CONTROL METHODS

. . . for a broaching machine

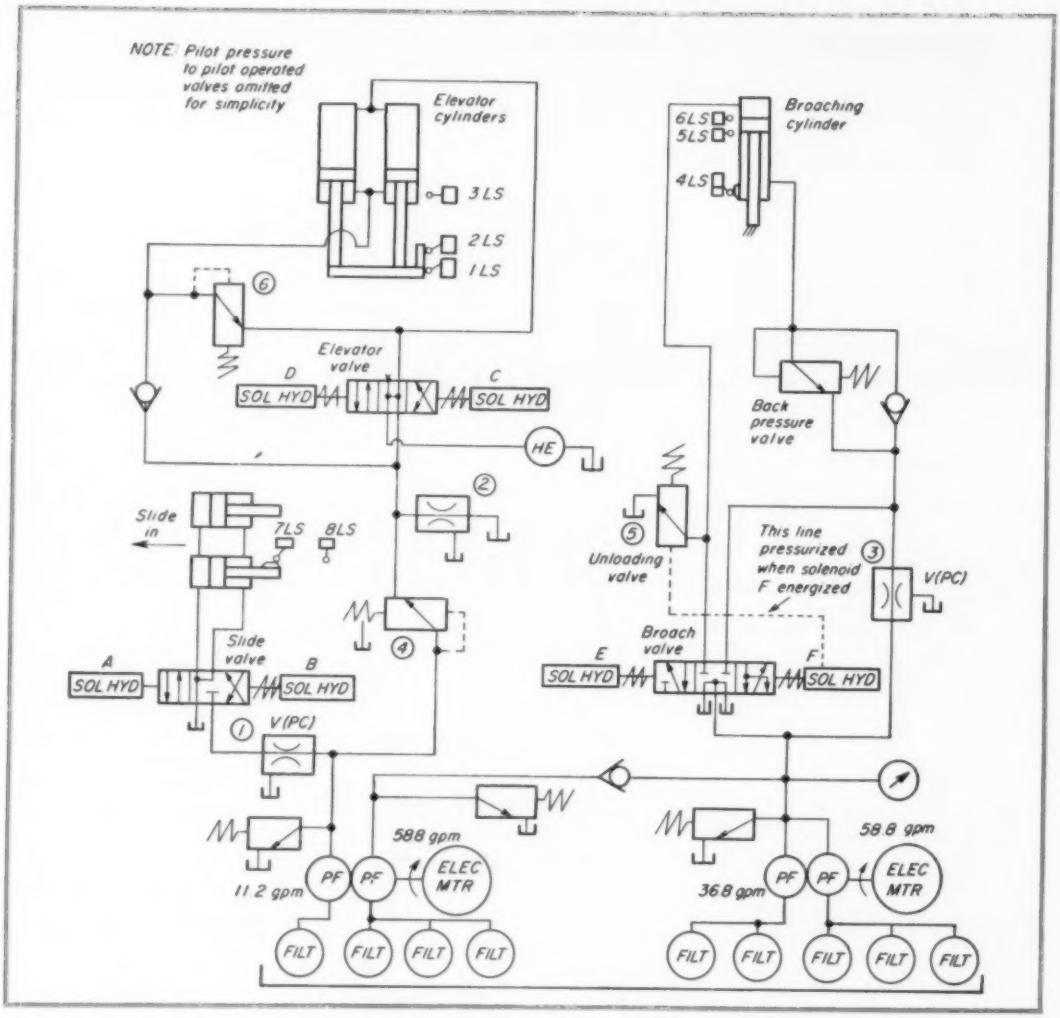
INTERNAL PULL UP BROACHING MACHINE has helical drive for machining internal gear teeth. Machine operation is to broach ID and gear teeth removing .015 stock on the ID and cutting 14-inch teeth through a 1-inch cut on a 50-inch lead.

IN the development of an all-hydraulic broaching machine, the control of cylinder speeds was an important consideration. The machine which is manufactured by American Broach & Machine Co. is designed for automatic operation with broaching speeds from 13 to 22 fpm. To obtain flexibility of speed control for the various motions, the broaching machine incorporates reliable speed control circuits such as meter-in, bleed-off, differential, and combination of pump outputs.

In one installation, the broaching machine produces automotive automatic transmission reverse idler gears. The operator loads the gear blanks into two magazines and starts the machine cycle by pushbutton control. Two parts feed into a slide and are transferred to broaching position. The two broaches are pushed up through the parts by two elevator cylinders until they engage the broach pullers which lock onto the tops of the broaches. The broaches are then pulled up through the blanks, cutting helical, involute teeth from the solid stock. On completion of the cutting stroke, the elevator cylinders stop while the broaching cylinder continues up. This disengages the broaches from the elevator, so that the slide can move out and eject the parts. After the broaches return, the cycle repeats. With the machine running on automatic cycle, the operator has only to keep the magazines filled with parts.

The two main drive motors of the machine are each 40 hp. With a pressure setting of 750 psi, the unit has a normal capacity of 50 tons. Using a broaching speed of 17 fpm, the machine produces 140 pieces per hour. At full broaching speed of 22 fpm the machine will produce approximately 200 pieces per hour with a cycle of 32 seconds.

Two double pumps supply the circuits. One of these pumps has outputs of 11.2 and 58.8 gpm and the other has outputs of 36.8 and 58.8 gpm. To supply fluid for the broaching cylinder which has a 13-inch bore, sections of the pumps are piped together for a combined capacity of 154.4 gpm. The 11.2 gpm section of the smaller pump supplies the elevator cylinders and the slide cylinders. Sequencing is maintained by limit switches actuated by the cylinders. ▼▼▼



HYDRAULIC CIRCUIT and sequence chart indicate solenoid and limit switch operation. Valve 1 forms a meter-in circuit for the slide cylinders. Valve 2 forms a bleed-off circuit for the elevator cylinders. On the down stroke of these cylinders, a differential circuit is formed through sequence valve 6. Valve 3 forms a bleed-off circuit for the broaching cylinder. The back pressure valve is required to provide a cushioning pressure to prevent the broach from jumping each time a broach tooth leaves the work and the required force becomes less. While the broaching cylinder is lowering, unloading valve 5 is opened by pilot pressure, so that drain fluid from the head end of the broaching cylinder is directed through this valve as well as the broach valve. Installing this unloading valve close to the broaching cylinder permitted a 3-inch line to be reduced to a 2½-inch line from the unloading valve to the broaching valve.

SEQUENCE OF OPERATIONS

SEQUENCE	SOLENOID	TOTAL TIME CYCLE — 7-LS, 2-LS, 3-LS, 6-LS, 8-LS, 5-LS, 4-LS, 1-LS
SLIDE IN	A	
ELEVATOR UP	C	
MAIN UP	E	
SLIDE OUT	B	
MAIN DOWN	F	
ELEVATOR DOWN	D	

APPLIED HYDRAULICS

COMPONENT DESIGN ARTICLE

COMPARING 3 SERVO VALVE DESIGNS

Both direction and speed of a fluid power actuator are controlled by servo valves which are continuously positioned mechanically or electrically. Operating characteristics of three basic servo valve designs are discussed in this article.

- 4-way spool valve
- Baffle-and-nozzle valve
- Jet pipe valve

• By W. G. Holzbock

1 4-WAY SPOOL TYPE VALVE

ONE advantage claimed for the 4-way valve is that at the moment of spool displacement the full hydraulic pressure is applied to the piston. However this advantage applies only to an ideal valve. Another more decisive advantage of the 4-way valve is that generally it is better for handling larger flows than either the baffle-and-nozzle or the jet pipe designs. The disadvantages of the 4-way valve are the rather high flow forces that are involved and the difficulties of manufacture.

Load Characteristics: Ideally when the spool is in its neutral position, the ports hould be closed and the slightest displacement should open them. However under manufacturing conditions this can hardly be obtained, and either overlap or underlap is the result. With overlap, the spool lands are wider than the ports, and finite displacement of the spool is required before the ports open. Thus there is a deadband or range of no output in the valve. This is usually undesirable, and the underlapped condition shown in Figure 1 is generally preferred.

The result of underlap is illustrated in Figure 2. For a valve with zero lap shown in (b) the smallest displacement of .001 inch permits the full pressure of 950 psi at the load. However with an underlap of .005 inch shown in (a) the characteristic changes completely and for the same displacement, the maximum obtainable pressure is only 250 psi. Hence, what appears to be an advantage of the

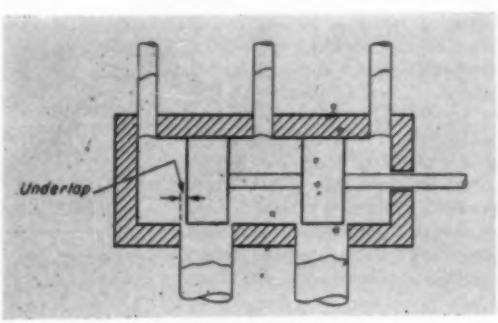


FIG. 1. Underlapped 4-way spool valve.

W. G. HOLTZBOCK, *Head of Products Development Section, Askania Regulator Co., Chicago, Ill.*

4-way valve—maximum load pressure with minimum displacement—is lost because of manufacturing limitations.

Flow Forces: Figure 3 illustrates the flow through the valve ports of a conventional 4-way valve. The velocity is greatest at the outlet port and consequently the static pressure is lowest at this point. The velocity at the inlet port is comparatively low, because the cross sectional area of the flow path is much larger than at the outlet port. Hence the static pressure at the inlet port is relatively high. The result is that the pressure components along the axis of the spool are larger toward the left than toward the right and tend to close the valve. Examination of Figure 3 shows that the flow direction may be reversed without altering the direction of flow force. Therefore the flow forces oppose the opening of such a valve. The magnitude of these flow forces can be expressed with certain assumptions by:

$$F = .0045\, q\sqrt{p}$$

where F is the flow force in lb, q is the flow in cu. in./sec, and p is the pressure drop through the port in psi.

This force has to be overcome by the input signal. When only a weak input signal is involved, such as that obtained from a commercial electronic controller, the flow force presents a problem that may impede the performance. In a practical case, the pressure drop might be 200 psi, and the flow, 3 cu. in./sec. The resulting flow force would be about 3 ounces.

Valve configurations such as the one shown in Figure 4 have been developed to replace the abrupt bends of the spool by streamlined surfaces. The flow forces are considerably reduced, but this design involves rather difficult machining of surfaces and this may become a serious cost factor.

Hole-and-plug valve: The purpose of the hole-and-plug valve is to obtain zero lap at a lower cost than the spool valve. Figure 5 is a schematic drawing of the hole-and-plug valve. The valve consists of valve plate and valve body with their flat, ground surfaces facing each other with a minimum of clearance. Essentially the operation is the same as in any 4-way valve, depending upon a relative displacement of valve plate and valve body. Cylindrical inserts are installed in the plate and body. To prepare the holes into which they are inserted, the valve plate is aligned with the valve body and a hole is drilled straight through the two pieces. This is considerably easier than making square ports as is customary in conventional spool valves to obtain a linear flow vs. displacement relation. Assuming that the outer edge of the lower cylindrical inserts are perfectly square, the surfaces are flat, and the space between plate and body is negligible, a perfect zero-lap valve should be obtained. However, it is more difficult to make this

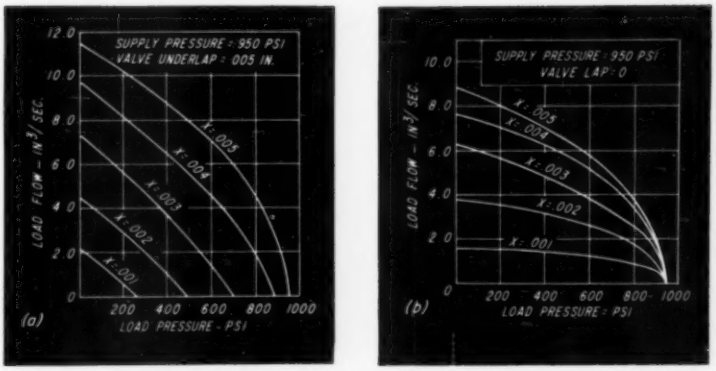


FIG. 2. Flow characteristics of 4-way valve for various spool displacements. (a) Underlapped valve (b) Zero lap valve.

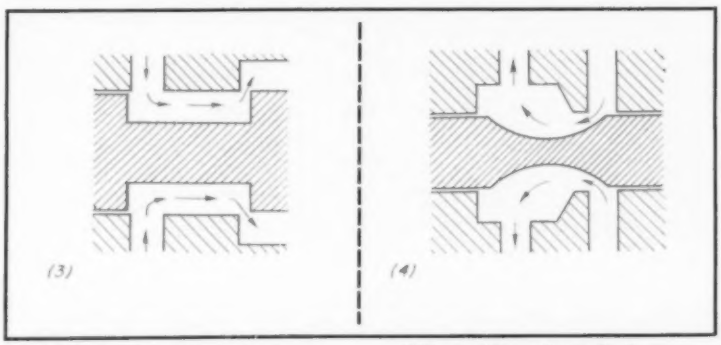


FIG. 3. Flow through 4-way spool valve.

FIG. 4. Flow through force-compensated 4-way valve.

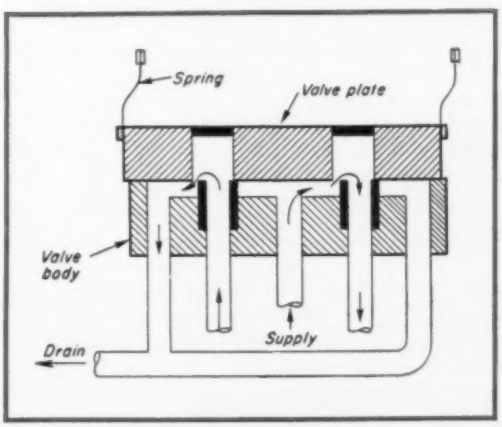


FIG. 5. Hole-and-plug valve.

valve than it seems, because in general it is easier to reduce the clearance between cylindrical surfaces, such as between a spool and sleeve, than between flat surfaces. Furthermore, the warping of the valve plate due to temperature changes or hydraulic pressures presents a problem. Nevertheless, these valves are being successfully made, and only experience can prove how advantageous they are. This valve does not overcome the flow forces. Where this is desired, shaping similar to that illustrated in Figure 4 is necessary.

2 BAFFLE-AND-NOZZLE VALVE

The principle of the baffle-and-nozzle design is to pass the fluid through two restrictions in series. One of these may be arbitrarily called the orifice, the other, the nozzle. Figures 6a and 6b show two customary arrangements. If the baffle closes the nozzle completely, the hydraulic pressure applied to the actuating piston builds up to the supply pressure. If the baffle moves away from the nozzle, fluid flows out of the nozzle and the resulting pressure drop across the orifice minus the pressure drop across the nozzle determines the nozzle back pressure applied to the actuating piston. Thus the nozzle back pressure can be controlled by the deflection of the baffle.

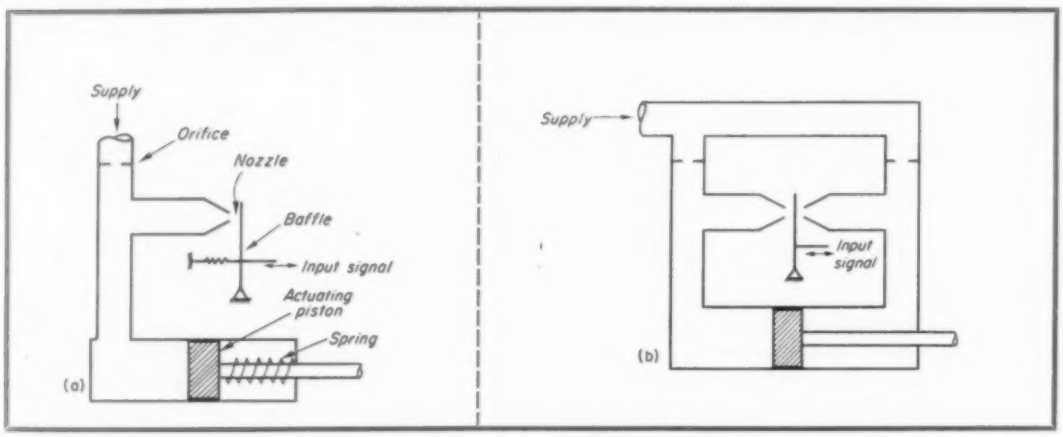


FIG. 6. Baffle-and-nozzle valve. (a) Single-nozzle valve, (b) twin-nozzle valve.

Single and twin nozzles: In Figure 6a the nozzle back pressure is balanced by the spring in the actuating cylinder. The disadvantage of this arrangement is in the loss of energy in compressing the spring. The twin-nozzle system of Figure 6b does not require such a spring. However the spring is an easy way to obtain a fail-safe feature. In case of hydraulic power failure, the spring drives the actuating piston to the left.

Flow forces: for industrial applications it is generally not advisable to have a nozzle area of less than about .001 in^2. Otherwise clogging by dirt particles in the oil may become a problem. Considering a hydraulic pressure of 200 psi, the force on the baffle under these conditions could build up to about 3 oz. This is about the same as for the 4-way valve. This relatively large force is a serious limitation.

The great advantage of the baffle-and-nozzle valve is the small mass of well-designed baffle. This makes the design suitable for applications at frequencies in the order of 50, 100, and even 200 cycles per second.

Linearity: The valve is not linear because the nozzle back pressure is not proportional to the baffle deflection. This non-linearity can be reduced to a minimum by limiting the baffle deflection and consequently the range of nozzle back pressures at which the valve operates. The reduced pressure range makes it desirable to add a second stage which in turn controls the output power over the full pressure range. Usually this second stage is a 4-way valve which is positioned by the nozzle back pressure. With some applications the inherent flow limitation of the orifice requires 2-stage operation. The flow through the orifice has to be small or the turbulence of the fluid leaving the nozzle would become a problem. A 4-way valve second stage is desirable to handle larger flows without great difficulty.

3 JET PIPE

In both the 4-way valve and the baffle-and-nozzle arrangement, the problem of flow forces is present. In the jet pipe design one of the most important characteristics is that flow forces are practically non-existant.

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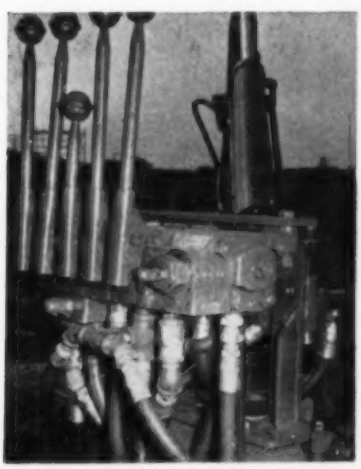

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Because of the parallel circuit built into these valves, simultaneous operation of two or more cylinders makes digging and load discharge one smooth continuous operation.

Consisting of an inlet section, five working sections and the outlet section, this tandem valve controls the operation of the cylinders which actuate the boom, swing, lift, crowd and bucket. The built-in combination safety relief-pressure control gives safety protection to the entire hydraulic circuit and prevents overloading the structural members of the equipment. The design of these new valves makes it a simple matter to incorporate special feature valves to give plus values to the equipment.

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3 SERVO VALVE DESIGNS

Operation: Jet pipe action is illustrated in Figure 7. The jet pipe swings in a vertical plane around a horizontal axis. It is supported by a ball bearing pivot and a sleeve bearing. Oil is pumped through the jet pipe at a constant pressure usually between 100 to 400 psi depending on the application. The oil is directed from the top of the jet pipe to the two closely adjacent receiving orifices in the distributor block. These are connected with the opposite ends of the actuating cylinder.

With the jet pipe in its mid-position, equal pressures exist in each receiving orifice, and consequently the pressures on each side of the actuating piston are equal. With the slightest deflection of the jet pipe, one orifice receives more oil than the other, creating a difference in pressure between the two ends of the actuating cylinder and causing the piston to move in response to the jet pipe deflection.

Linearity: The relation between jet pipe displacement and static recovery pressure in the receiving orifices is shown in the graph of Figure 8. Under normal operation, the jet pipe deflection would be limited by stops to about .03 in. on either side of center. Near the midposition, the action is quite linear, while toward the extremes non-linearities creep in. The conversion of the oil static pressure into velocity pressure in the jet stream between jet pipe tip and receiving orifice, and the subsequent reconversion into the static recovery pressure results in a certain pressure loss. The recovery is about 96%, so that with a 100-psi supply pressure, the pressure at the actuating piston is 96-psi when the jet pipe is fully deflected.

Load Characteristics: The relation between the flow to the actuating cylinder and load pressure at various degrees of jet pipe deflection is shown in Figure 9. Comparing this with Figure 2a, it is interesting to note that this characteristic of load pressure vs. load flow is the same for the underlapped 4-way valve as for the jet pipe.

Comparing the jet pipe to the 4-way valve, the latter is a better device to control large flows at high pressures. The jet pipe can be compared with an electrical voltage amplifier: it is ideal for weak input signals. Where high electrical power output is required, a power amplifier is generally coupled with the voltage amplifier. With hydraulics, the 4-way valve which is an excellent design for large flows at high presures is the power amplifier and is frequently coupled with the jet pipe stage. ▼▼▼

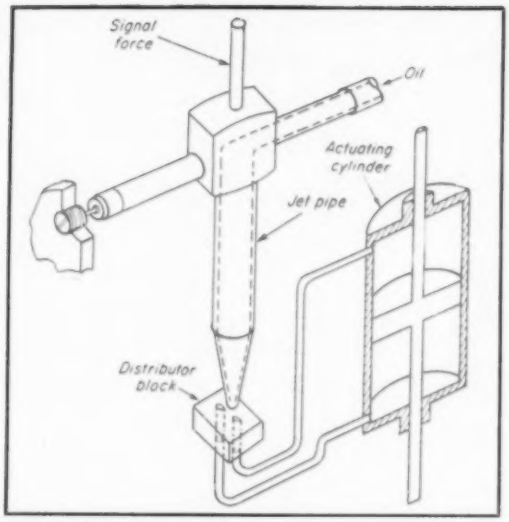

FIG. 7. Jet pipe operation.

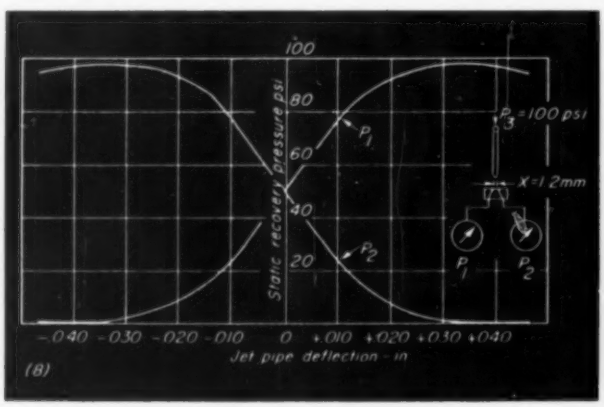

FIG. 8. Static recovery pressure as a function of jet pipe deflection.

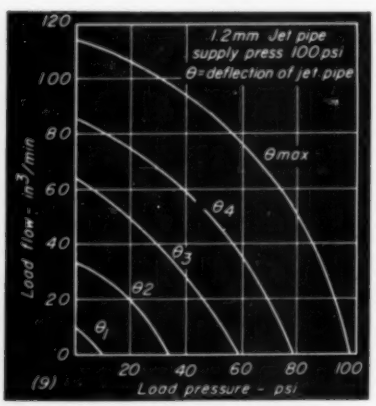

FIG. 9. Typical flow pressure characteristic of jet pipe.

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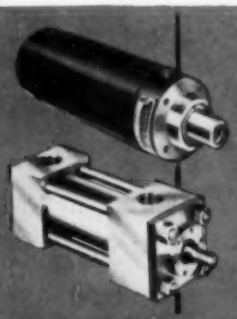

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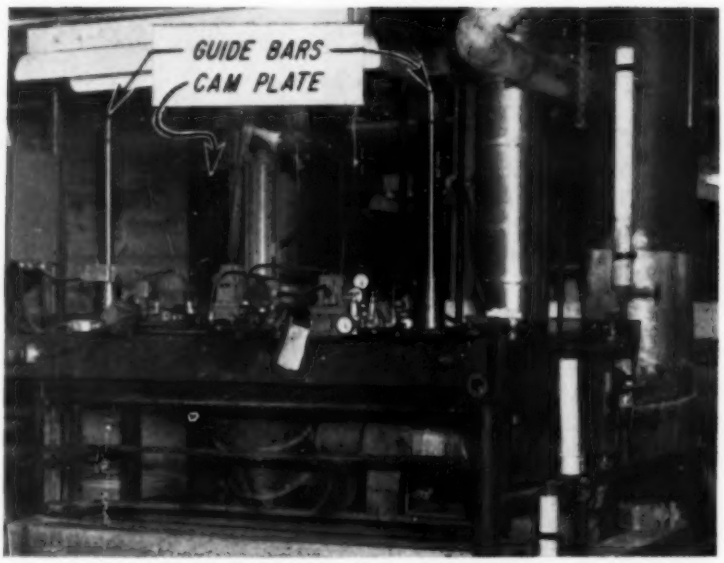
... on a

● By Paul H. Winter



DIPPING EQUIPMENT is mounted on trolley over chemical and rinse tanks. Guide bars mounted on rack slide through bushings mounted on sliding ways perpendicular to trolley rails. Cam plate sliding on stationary rod imparts oscillating motion to rack for rinsing.

Much practical planning went into the design of this in-plant equipment. Now completely automatic, the equipment synchronizes horizontal cylinder motion with vertical cylinder motion. Electrical timers regulate the chemical treatment and rinse.

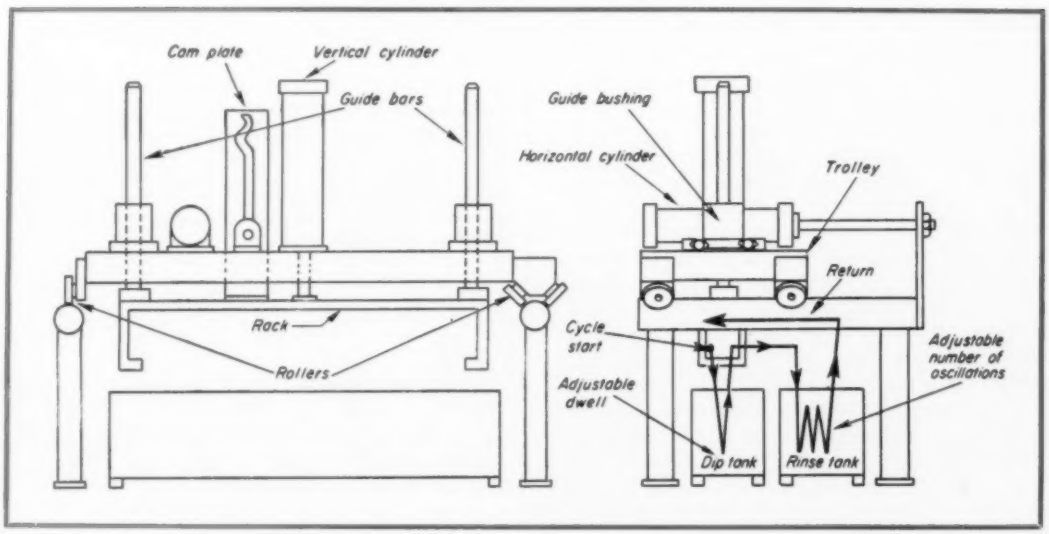
DEVELOPING an automatic machine for dipping porcelain in a chemical treatment and rinse became a very interesting project in pneumatic and electrical circuit design. A special chemical treatment of porcelain at Pass & Seymour, Inc. requires that the pieces be immersed in a solution for a variable length of time and then transferred to a rinsing bath. Porcelain is customarily handled on wareboards which are flat wood or metal boards about six feet long and one foot wide. When it was decided to mechanize this dipping operation, it became apparent that the most economical method would be to construct special perforated metal wareboards which would not require removal of the work for the dipping operations, but would permit the immersion of the fully loaded wareboard in the two tanks.

Analyzing the specifications for a machine that would perform this operation, it was obvious that

PAUL H. WINTER, *Chief Engineer, Pass & Seymour, Inc., Syracuse, N. Y.*

MOTIONS ARE CONTROLLED

mechanized dipping operation



only two basic movements had to be imparted to the wareboards: a vertical motion to immerse and lift the boards out of the tanks, and a horizontal motion to transfer the boards from one tank to the other. However there were a considerable number of specific control requirements which resulted in an interesting circuit arrangement. It was necessary that the dwell in the first tank be easily adjustable for different compositions.

It was also necessary that the amount of active washing in the rinse tank be easily changed. After an experimental investigation, it was decided to oscillate the wareboards vertically in the rinse tank and at the same time impart a slight horizontal oscillating motion. The number of vertical oscillations would depend on the particular piece being treated. The maximum vertical downward speed had to be limited to prevent the work pieces from floating off the wareboards. To reduce the overall cycle time, the equipment was designed with a fast approach to the tanks and a slow immersion.

The equipment is built on a trolly which rolls on two rails over the two tanks for chemical treatment and rinse. Movement of this trolley is accomplished with a horizontally mounted traverse cylinder. A vertically mounted cylinder raises and lowers a rack which supports the pieces to be processed.

Two guide bars, mounted on the rack, slide through bushings which are mounted with the other components on sliding ways perpendicular to the trolley travel. A cam plate on the rack follows a roller on the trolley, so that the curvature of the cam track imparts a horizontal oscillating motion to the rack. This is necessary for the rinsing operation. Because both the vertical and horizontal cylinders had to be mounted on the moving trolley, all electrical and pneumaitc components were also mounted on the trolley to keep the number of moving hose and cables to a minimum.

A counter balance valve in the line from the rod end of the vertical cylinder maintains a back pres-

sure to prevent the load from falling and permits regulating the downward speed by the flow control valves.

PNEUMATIC CIRCUIT

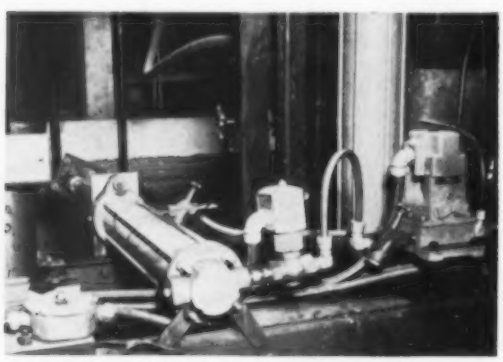
In order to decrease the downward speed of the vertical piston before the rack enters the tanks, the lower port of the vertical cylinder is connected to a 4-way valve through two parallel lines both of which have speed control valves and one of which has a solenoid shutoff valve. A cam on one of the guide bars operates a limit switch which closes this solenoid valve just before the rack enters the tanks. This restricts the metered air flow from the vertical cylinder and slows the rack descent.

ELECTRICAL CIRCUIT

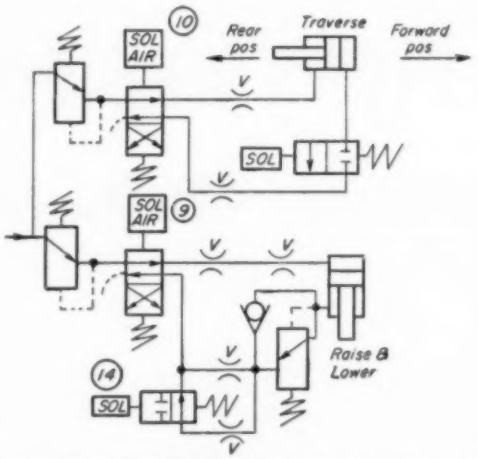
The cycle is initiated by pushbutton switch 13 shown in the electrical circuit; and then continues through a timed dip in the chemical tank, traverse to the rinse tank, repeated raising and lowering in the rinse with accompanying horizontal movement, and return to starting position. Time delay relay 4-CR controls length of chemical treatment and its contacts are actuated after a preset time delay. Time delay relay 5-CR controls rinse time and its contacts are actuated after a preset time delay. This use of a timer to regulate the number of vertical rinse oscillations has proved itself extremely convenient and changing the cycle for different pieces is done by relatively unskilled personnel. The timers are housed in the control panel and their adjusting screws extend through the cover.

Limit switch 6-LS is actuated at the top of the rack stroke. Limit switch 7-LS is actuated when

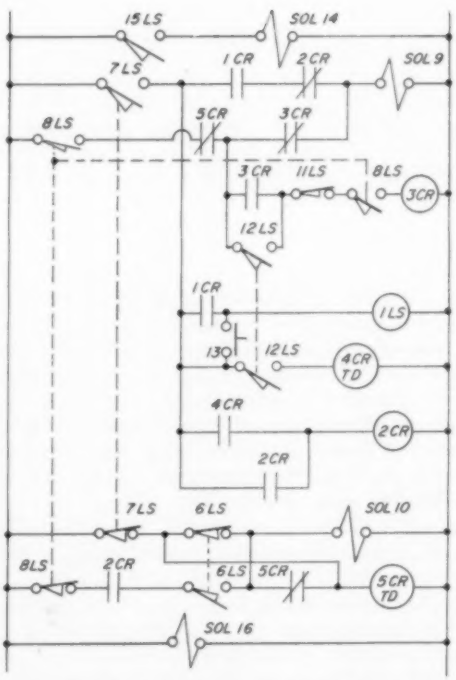
Concluded on page 90



TRAVERSE CYLINDER is controlled by 4-way solenoid valve at right. Two-way solenoid valve is safety device to prevent movement of cylinder if electrical power is lost. It is installed close to cylinder to prevent formation of air pockets. Flow controls in both lines to cylinder permit control of traverse speed.



PNEUMATIC CIRCUIT provides fast lowering and controlled dipping speed giving the shortest cycle time without danger of parts floating off rack. Counterbalance valve in line to rod-end of raise cylinder provides back pressure to prevent rack from dropping. Two-way valve in same line initiates slow lowering into tank.



ACTUATING PUSHBOTTON 13 starts cycle which proceeds through operations of timed chemical dip, transfer to rinse tank, timed rinse, and return. Sequencing is initiated with limit switches which actuate solenoid controlled valves.

Circle 97

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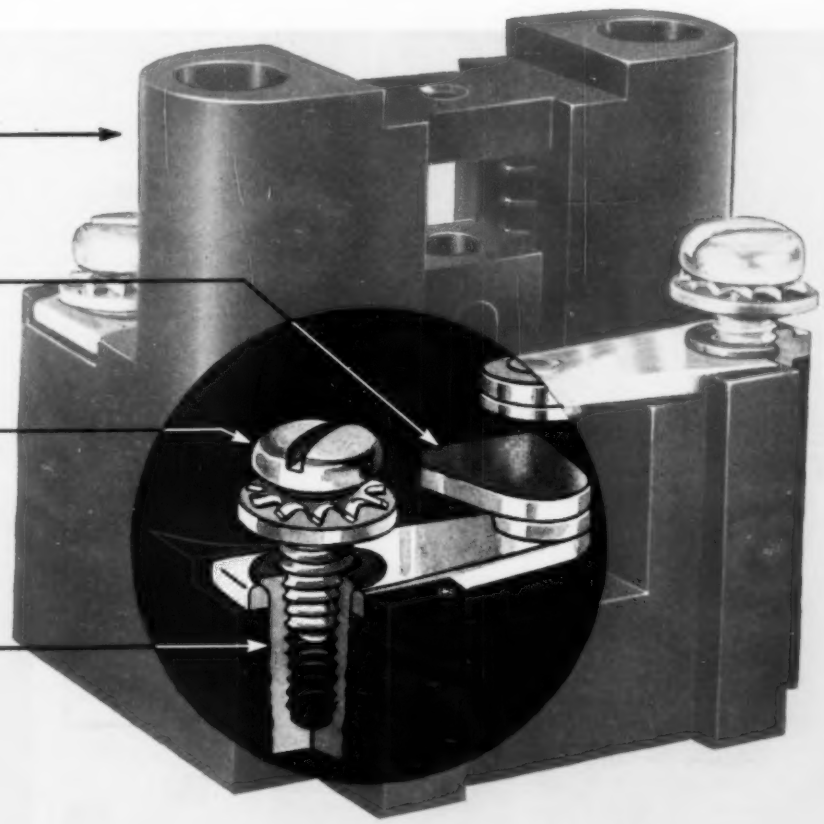
Shown here are only a few of many reasons why the GOLD-N-RING Control Switch makes it possible to match machine tool mechanical ruggedness with equally durable electrical efficiency.



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How an automatic transfer problem

IS SOLVED WITH ELECTRO

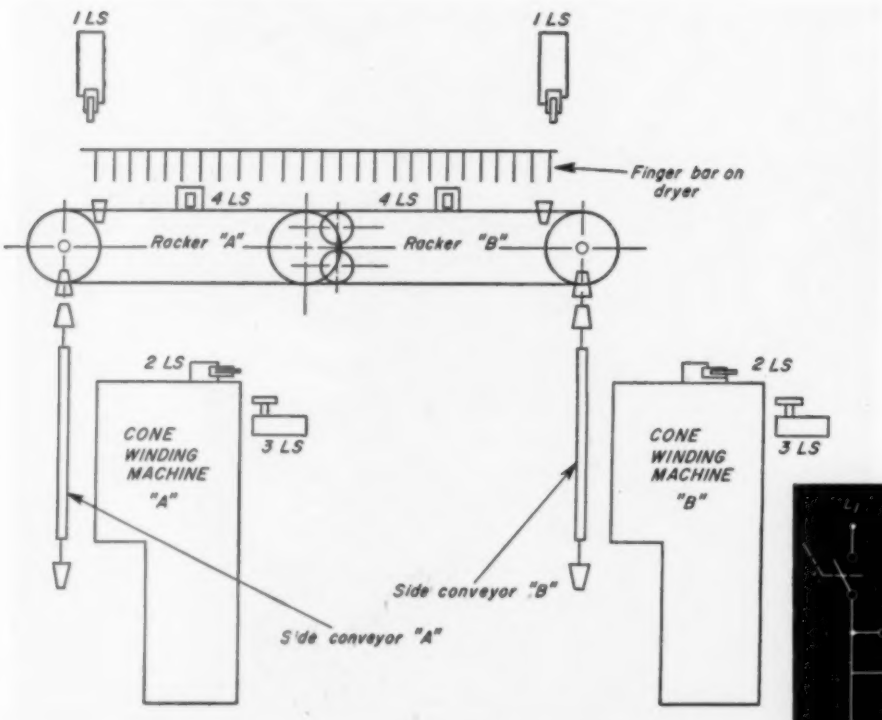
• By J. B. Patterson

CONTROLLED air power used on a machine which automatically transfers paper textile cones from a winding machine to a dryer reduces costs and human drudgery.

For many years this loading operation had been done manually with a cost that was greater than the cost of winding the cones. A unit consisting of two winding machines located in front of a pin type conveyor dryer was served by an operator who picked up cones as they came from the winders and placed them on continuously moving pins of the dryer.

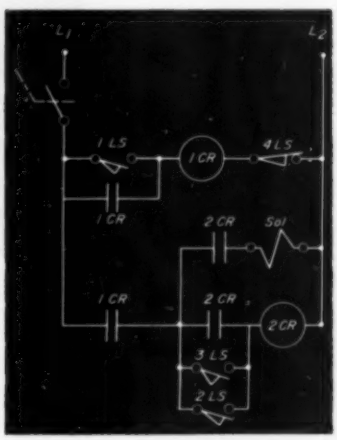
It was desired to accomplish automatic transfer

J. B. PATTERSON, *Sonoco Products Company, Hartsville, S.C.*



1

TWO IDENTICAL work transfer mechanisms take cones from the winding machines to dryer.



2

ELECTRICAL controls for one of the transfer units assure accurate handling of paper textile cones.

APPLIED HYDRAULICS

PNEUMATIC APPLICATION ARTICLE

-PNEUMATICS

without disturbing this general arrangement or upsetting seriously any of the existing equipment for reasons of space limitations and costs.

The problem involved the transfer of cones from two separately driven winding machines to pins of a continuously moving chain conveyor. The pins are fixed to angle iron bars on 3 inch centers, 23 pins per bar. The transfer mechanism is designed to permit independent starting and stopping of the winding machines without disturbing the movement of cones through the dryers.

A pair of chain conveyors, the rackers, was devised for location immediately in front of the dryer, with each conveyor mounted on separate levels, such that cups on 3 inch centers present cones to 22 of the 23 pins, 11 pins for each level.

Each of these conveyors is driven from the winding machine it serves, and in turn is served by a chain conveyor, at right angles to it which receives cones from the winding machine onto formed pins spaced on 3 inch centers. All conveyors move intermittently, each pair being driven by a ratchet and crank from the winding machine it serves.

When the conveyors are not being indexed, it is necessary to:

1. Transfer cones from winders to side conveyors
2. Transfer cones from the side conveyors to the cup conveyors (rackers)
3. Move cones from the cup conveyors to the dryer pin conveyor.

All these transfers are simply performed by 4-way valve controlled cylinders. The first two transfers are controlled by cam actuated air valves which are tripped in time with the winder. The third motion is initiated by a solenoid valve which controls a cylinder actuated carriage having a pusher bar as long as 11 cone positions. As the bar moves out it pushes 11 cones out of the cup conveyor on to the dryer pins.

Successful transfer to the dryer demanded these conditions be met:

1. Cups must be in line with pins (both vertically and horizontally) when transfer takes place.
2. All cones delivered to transfer position must be removed, both when winding machine is running and when it isn't.

For condition 1, it is realized that with the pins presenting themselves at the rate of 3 rows per minute the conveyor moving at 33 steps per minute, not only must the solenoid valve be actuated at a time when the pins reach a correct horizontal position, but also at a time when the racker is not moving.

A solution was reached by using two limit switches with relays before the solenoid valve. 1LS, receiving an impulse from a timing device on the dryer, actuates relay 1CR and holds until 2LS receives an impulse from a cam on the winder to actuate the valve through 2CR. The air valve now directs air to move the pusher bar cylinder forward to place the cones on the dryer pins. At

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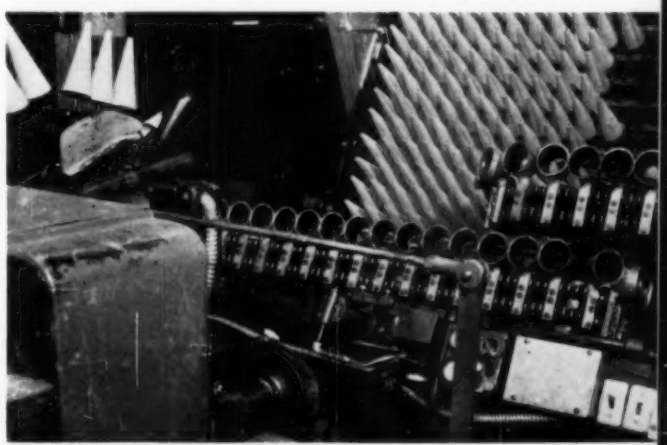

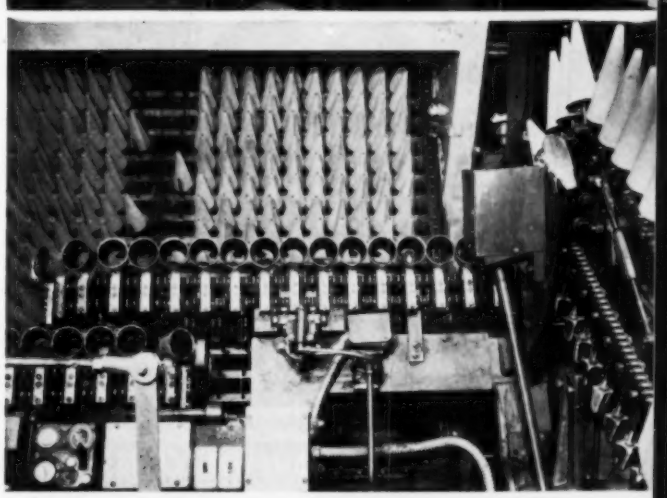

3

PHOTOS show sections of both units which transfer paper textile cones from winders—to side conveyors—to rackers—to drying racks.

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for ADVANCED DESIGN.

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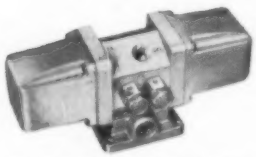

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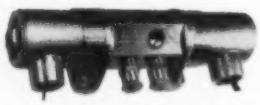

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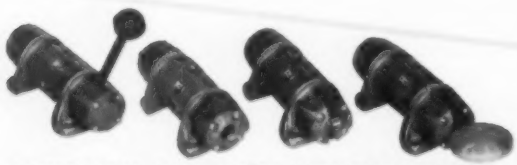

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Circle 16 on Reader Service Card

AUTOMATIC TRANSFER MACHINE

Concluded from page 89

the end of pusher bar stroke, 4LS breaks the circuit to return the bar.

For condition 2, it is realized that if the winder is shut down at any time when one of more cones are in transfer position on the racker and a dryer pin bar comes by before the machine is again started, some cones may pass by the transfer position without being transferred. The simple solution to overcome this possibility was to use a switch, 3LS, tied in with the winder motor control which closes when the winder is stopped to take the place of the cam operated limit switch, 2LS.

This installation offered the rare opportunity to use exhaust air for doing work. After cones are transferred into the cup coneyor, they require a light tap to firm them in the tapered holes. This is done by blowing the exhaust air against a spring return hinged leather paddle located between the cone and an exhaust outlet.

The first machine of this type has been operating on a five day 3-shift basis for over six years, and has been duplicated many times for tremendous savings. ▼▼▼

MULTIPLE MOTIONS CONTROL

Concluded from page 86

the frame is in the forward position over the chemical tank. Limit switch 8-LS is actuated when the frame is in the rear position over the rinse tank. Limit switch 11-LS is actuated momentarily as the rack rises. Limit switch 12-LS is actuated when the rack reaches the bottom of its stroke. Limit switch 15-LS is actuated when the rack approaches the tank.

SAFETY CONSIDERATIONS

In analyzing the circuit for the results of possible air or electric failures, no harm to machine or operator appeared possible with an air failure because the only motion which could occur was a slow descent of the vertical cylinder. However with the single-solenoid, spring-return valves which were used, an electrical failure might have caused the horizontal cylinder to move the rack while it was still inside one of the tanks. This would either upset the tank or seriously damage the mechanism. A fail-safe device was therefore indicated.

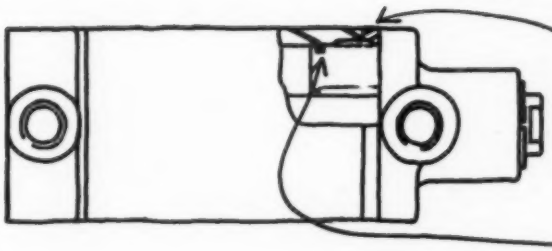
A 2-way solenoid valve is connected to the head end of the traverse cylinder and energized when control power is on. In case of power failure this valve prevents movement of the traverse cylinder. The valve is installed as close as possible to the cylinder to avoid any pocket of air which might initiate piston movement. ▼▼▼

INTER-OFFICE

Engineering Department

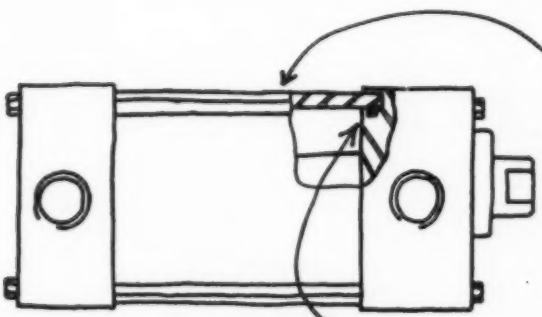
MEMO

Jim - Here's why I think Pathon Hydraulic Cylinders fit our long stroke applications better.



Pathon head is attached by a single screw thread.

Head seal is a true static seal - will give us much longer life.



Higher pressures will stretch the tie-rods on this cylinder - heads will move relative to the tube

This makes head seal dynamic - subject to wear and subsequent trouble

NOTE THIS JIM: Pathon Cylinders fit the bill in shock loads too. We can use the greater strength that Pathon single screw thread attaching method provides.

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Ψ could designate P. S. I. - 101

One practical and proven use of accumulators is to absorb shock in a hydraulic system. Here's how a hydropneumatic spring added to a fork lift truck saved many maintenance dollars.

SHIFTING INGOT load is cushioned by an accumulator as scoop maneuvers and tilts. Formerly uncushioned shocks caused breakdowns in hydraulic cylinder.

ACCUMULATOR CUSHIONS A SHIFTING LOAD

A COPPER ingot bar handling job at U.S. Metals Refining Company played havoc with the hydraulic system on the fork lift truck because the heavy shifting load produced shock. Adding a one pint accumulator to the circuit smoothed out the operation and helped to eliminate breakdowns and costly repair work resulting from the shifting load.

Very important additional benefits obtained by the cushioned circuit are reduction of operator fatigue, speeded up loading, and greater assurance of maintaining schedules for material flow.

Each full scoop of ingots weighs about 1000 pounds. Because these ingots are picked up from a pile in which they are lying "any which way," severe shocks can occur as the shifting ingots are lifted moved or emptied. In this kind of service, without any cushioning device in the circuit, the main hydraulic cylinder of the truck sometimes was bent, in some cases so severely that the pistons could not be pried out. Such breakdowns are costly and can cause serious delays on the loading platform.

INSTALLATION OF THE ACCUMULATOR

Installed at a cost of under $100, the accumulator used on this truck is a small steel shell containing a rubber bag which is precharged with nitrogen. It is simple to install and the maintenance consists of occasionally checking the precharge which is kept at the same level as the hydraulic pressure of the truck circuit. The one pint accumulator is mounted on the fork plate of the truck. It is connected with the main cylinder circuit between the control valve and lift cylinder mechanism. Thus, the pulsations, or shocks transmitted to the hydraulic circuit are absorbed within the accumulator shell by the contraction of the bladder.

Another desirable effect of the accumulator is to "float" the load. The entire sequence of fork action and movement of the scoop itself is unusually smooth. What used to be perceptible sharp bumps are now observed to be a floating motion of the load as the truck lifts, moves and empties. ▼▼▼

Circle 27 ⟶

matching wits with fire

Fire-resistant Celanese Cellulubes provide protection against the costly damage of fires and explosions.

When employed as the hydraulic fluid in die casting and similar critical operations, Cellulubes reduce the ever-present danger of uncontrollable fires caused by line breaks or other equipment failures. As air cylinder lubricants in compressed air systems, Cellulubes prevent the formation of excessive carbon deposits—the main source of compressor fires and explosions.

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APPLIED HYDRAULICS

CIRCUIT DESIGN ARTICLE

This sounds like a trick question: Can you get the same speed out of a machine using 3/4 inch valves as you can from a machine using 1 1/4 inch valves? Here's a circuit designed to use 3/4 inch valves instead of 1 1/4 inch without sacrificing speed or generating excess heat.

FLASH from die castings is trimmed on this press. All components are within

PRESS DIFFERENTIAL CIRCUIT

. . . uses smaller size valving

• By Rex Burnham

WORKING with John Krueger, Chief tool engineer, Congress Drives Div. of Tann Corp., in Detroit, a group of small trimming presses were developed which use a differential circuit without increasing valve sizes. These presses have tonnage ratings of from 30 to 75 tons, and do not require a decompression circuit.

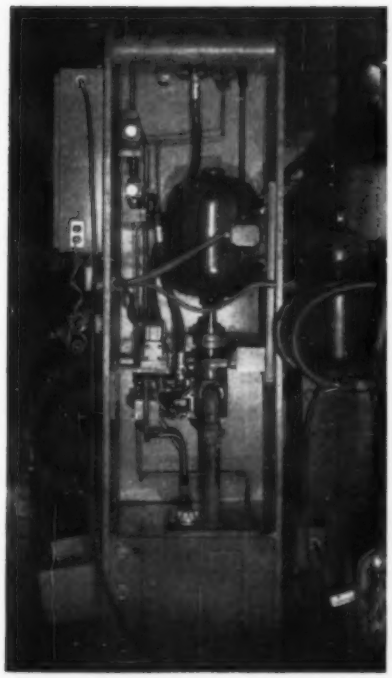
Many designs of feed circuits for presses and machine tables make use of the differential circuit to reduce the nonproductive time required for rapid approach. During rapid approach oil is taken from the rod end back into the head end, instead of dumping this oil back to tank as in a conventional circuit. When the cylinder being used has an annular rod area which is 1/2 the area of the piston head, this differential or regenerative action results in a rapid approach speed which is twice that of a conventional circuit in which speed depends on pump volume alone.

When designing the differential circuit, lines and valves which must carry pump delivery plus oil taken from the rod end of the cylinder back into the head end must be made large enough to efficiently handle this extra volume of oil. Because the prices of valves nearly triple when 1-1/4 inch size is required as compared to 3/4 inch, a differential circuit can be considerably more expensive than the conventional circuit.

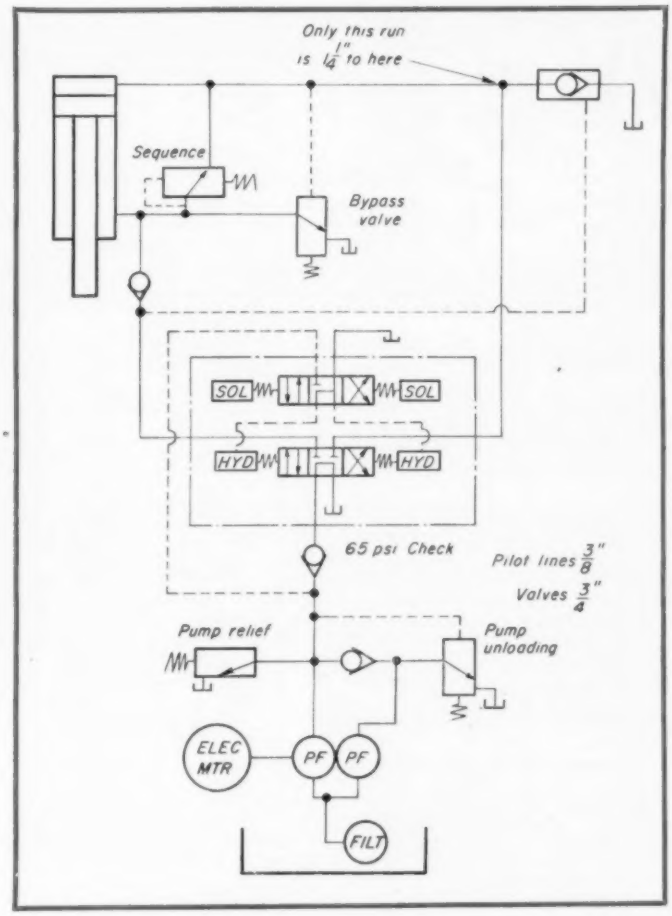
Design of the presses, which are used to trim flash from die castings at Congress Drives Division, is shown in the photographs and the hydraulic circuit drawing. This design is simpler than many other differential circuits used on presses of this type. Use of 3/4 inch lines and valves gives low initial cost. The circuit is arranged so that the 3/4 inch lines are not overloaded.

On this particular press, a tandem pump circuit is used, each pump has 11 gpm capacity. During rapid approach, 22 gpm from the pumps combines with 22 gpm out of the rod end of the cylinder, to flow to the blank end. The upper run of tubing

REX BURNHAM, *Manager, Hydraulic Division, J. N. Fauver Co., Inc., Detroit, Mich.*



the press frame; easily accessible from the rear.



OIL for high speed closing is supplied by two 11 gpm pumps and 22 gpm from the rod end of the press cylinder. When the work is contacted, one pump unloads and the cylinder rod end is opened to tank.

into the blank end of the press cylinder is only 1-1/4 inch line. All the rest of the lines and all valves are 3/4 inch. With this circuit layout, the top run is the only line required to carry the full 44 gpm during rapid aproach and 44 gpm during press opening. The 1-1/4 inch line can safely handle these volumes.

During rapid approach, when the circuit regenerates, a check valve and sequence valve control the direction of rod end flow to the blank end. This oil does not go through the 4-way valve. The 4-way valve only passes pump capacity so an oversize 4-way is not necessary.

The bypass valve in the line from the rod end of the cylinder is opened by pressure acting on the cylinder head end when the work is contacted. Opening of the bypass valve removes oil pressure from the cylinder rod end to permit maximum tonnage to be developed on the blank end during the work stroke.

During opening of the press, the 44 gpm flowing out of the blank end is divided so that part of the flow returns to tank through the 3/4 inch pilot operated check and part returns by way of the 4-way valve. Use of this pilot check prevents excessive pressure drop caused by excessive oil velocity.

When the press is idle, the piston is kept from drifting downward by oil trapped in the rod end of the cylinder by the closed bypass, sequence and check valve. Possible leakage past the closed bypass valve spool would be the only cause for drift.

This circuit could be modified to use a two position, 4-way valve. In this case, the sequence valve would act as a low pressure relief valve in the line to the rod end so that the press could be positively held open with live pressure. This is sometimes a desirable feature. With the pump motor stopped, piston drift due to gravity would be limited by the leakage which could get by the closed sequence and bypass valve.

By analyzing the flow in every line during all phases of the press cycle it has been possible to provide this economical circuit which keeps valve and line sizes small. ▼▼▼

over 8,000 Different Cylinder SELECTIONS—

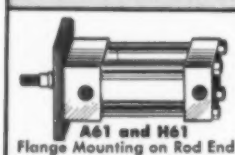
Miller AIR AND HYDRAULIC **CYLINDERS AND BOOSTERS**

"IN STOCK" for immediate delivery..

See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

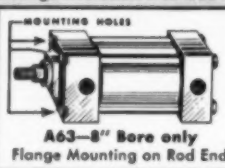
"IN-STOCK" MODELS

"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.

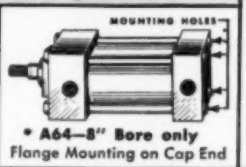


A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)

A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)

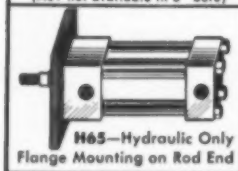


A63—8" Bore only
Flange Mounting on Rod End

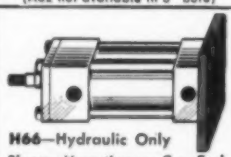


*** A64—8" Bore only**
Flange Mounting on Cap End

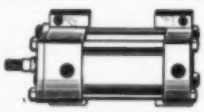
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



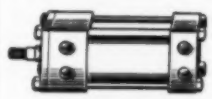
H65—Hydraulic Only
Flange Mounting on Rod End



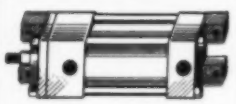
H66—Hydraulic Only
Flange Mounting on Cap End



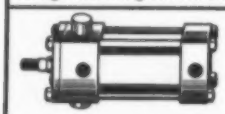
A72 and H72
Side Lug Mounting



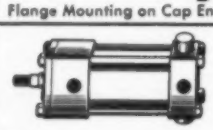
A74 and H74
Side Flush Mounting



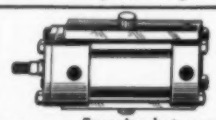
A77 and H77
Side or Foot Mounting



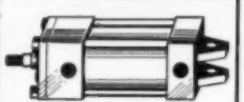
A81 and H81 Trunnion Mounting on Rod End



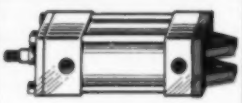
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap (one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES in Inches

"IN-STOCK" STROKES (in Inches)

	Bores	Rod Dia.	Rod Turn Down & Threads		1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
AIR	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

(1) (4) (3) (2) (1) (4) (3) (2)

"A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

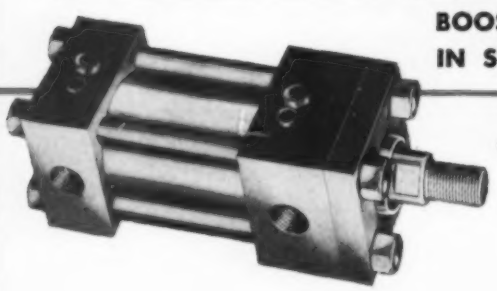
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model 84, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

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COUNTERBALANCE CYLINDERS

Problem Clinic

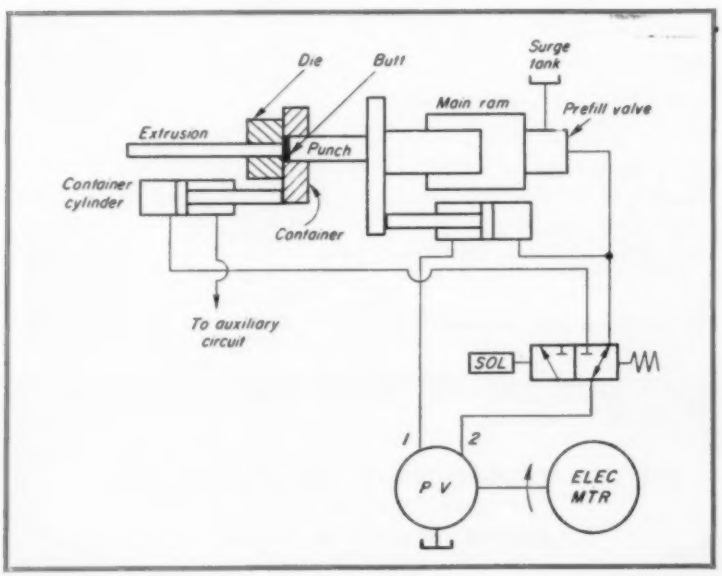
How long it takes a valve to shift or a pump to reverse can be a very troublesome bug in hydraulic design. The problem is even further complicated when accurate coordination is required. Time for valve operation usually runs from tenths to full seconds. Getting the right timing may mean sidetracking surge problems and jumpy operation.

VALVE OPERATING TIME

... is coordinated with pump reversal

● By Ransom Tyler

IN a recently designed extrusion press, a variable volume reversible pump was used to reduce valving and permit quick selection of extrusion speed. In the press circuit, the pump supplies fluid through port 2 and the 3-way valve to extend the main ram and force the extrusion through the die. At the end of the stroke, the 3-way is shifted directing fluid to extend the container cylinder. This opens the container so that the butt of the billet can be stripped off. The pump and the valve then reverse delivering fluid from port 1, so that the return cylinder retracts and positions the ram for the next cycle.

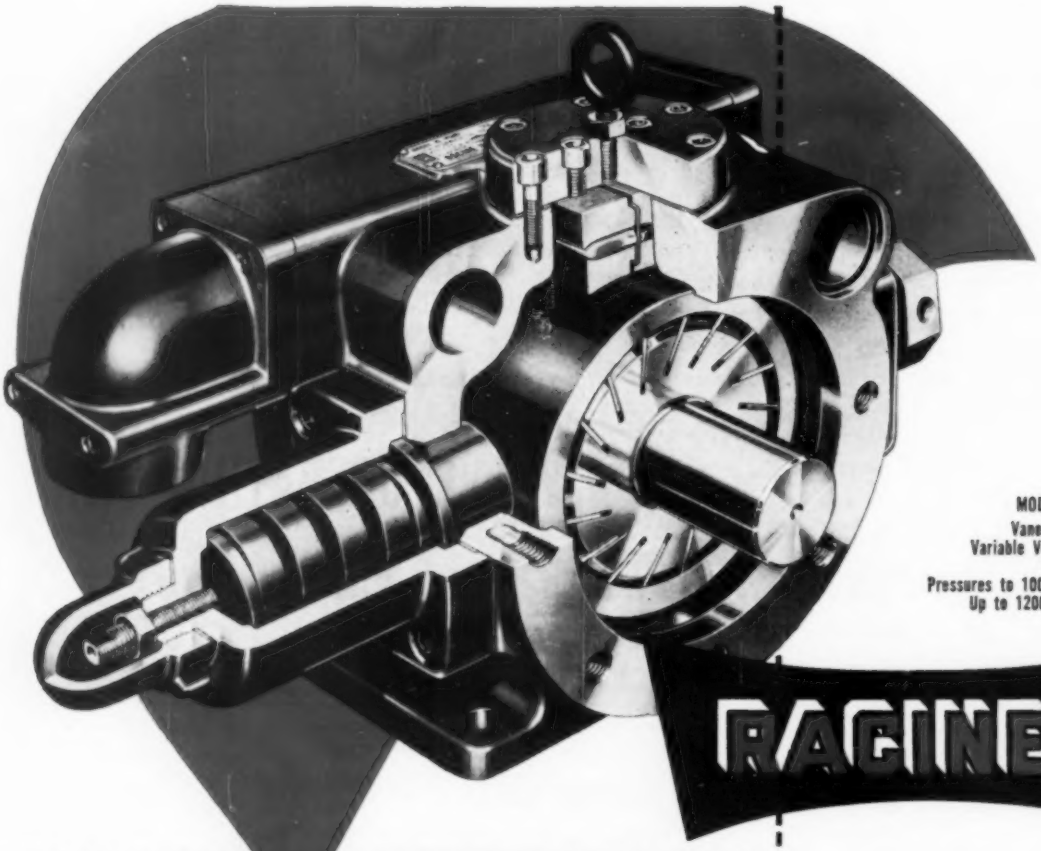


Simple as it seems, there's a problem of coordination between the valve shift and the pump reversal. Both of these actions must happen at the same time. If the valve shifts before the pump, the ram will again move forward before reversing. A development model of the machine was operated without a billet and the pump shifting time was about 1 second. When the valve shifted before the pump, a movement of as much as three inches was observed.

Fortunately the valve has an adjustment to control shifting time, so that it can be slowed down. However if it is slowed down too much the pump will reverse before the valve has completely shifted and opened the line from the ram. Fluid in the ram and return cylinder will be compressed, so that when the valve does open, the ram will jump back with considerable shock in the system.

Adjusting the valve timing solved this problem, but sometimes other methods must be used when temperatures vary or load variations affect the timing of valves. ▼▼▼

RANSOM TYLER, *The Oilgear Co. Milwaukee, Wis.*



MODEL K
Vane Type
Variable Volume
Pump
Pressures to 1000 psi
Up to 1200 rpm

RACINE®

WHY WASTE HORSEPOWER?

Hydraulic Power consumption is measured by the amount of oil pumped and the pressure needs of the circuit. Seldom do you need maximum output from the pump *and* top pressure throughout an operating cycle.

RACINE "Variable Volume" Pumps save horsepower because they pump only the volume of oil needed to operate the circuit.

By-passing of oil, heating, the cost of relief valves, excessive reservoir capacity, extra piping, all add to first cost and operating expense.

RACINE "Variable Volume" Pumps reduce these costs by simplifying your circuits. The Racine Model K Vane Type Variable Volume Pump shown above has a capacity of 70 gpm, with maximum pressure of 1000 psi at 1200 rpm. Other models in a full range of sizes from 5 to 70 gpm.

Why waste horsepower? Write today for complete information.

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Vane Type
50 to 3500 rpm
Pressures to 1500 psi

PRESSURE BOOSTER
Pressures to 5000 psi
Ratios to 7:1

4-WAY VALVES
Twin Solenoid
Pilot Operated

RESERVOIRS
With Control Panel
Designed to your space
and circuit requirements

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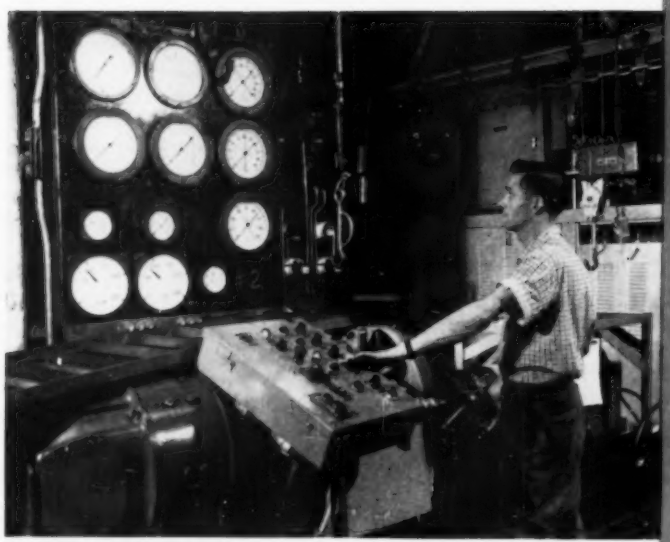
PUSH BUTTON CONTROL



NUMEROUS OPERATIONS required on this test stand for automotive transmissions are conveniently controlled from pushbutton panel. Pushbutton switches are mounted together with indicator lights and selector switches. Arrangement of units is planned according to operating sequence. Chevrolet-Cleveland Plant

Pushbutton switches, panel-mounted selector switches, and indicator lights are manufactured in a variety of types that permit much flexibility in designing the electrical and hydraulic circuits. A thorough familiarity with what's available will often permit elimination of unnecessary components and a simpler, more economical design.

● By Allan E. Morris
Associate Editor APPLIED HYDRAULICS

PART I

MANUAL actuation of electrical machine tool circuits is accomplished with a pushbutton. This unit may be one of many different types according to the function it performs and how frequently it is actuated. Even on machines which are primarily automatic and depend on limit switches or timers to maintain the cycle, pushbutton switches are used for initiation of the machine sequence and for set-up purposes.

Pushbutton control used with relays or contactors provides several advantages. Since the pushbutton control is in the low-voltage control circuit, operators are protected from dangers of high voltage. High voltage wiring between pushbutton-controlled contactors and the high-voltage equipment can be completely protected. In applications where a pushbutton switch is actuating a contactor which is in turn controlling a heavy current, a savings is effected because only the small control wiring need be run to the control station, and the heavier leads can be made as short as possible. Pushbutton controls also provide low-voltage protection, so that when power fails, the equipment will not be automatically energized when the power is restored, but will require restarting of the equipment.

PUSH BUTTON CONTROL

Because pushbutton switches can control relays which in turn control many other functions, the switches can be grouped together on a panel for convenience and simplicity of operation. This is also important in consideration of the limited space available on many installations. A single compact location for the control is an advantage on many machines, but in some cases it is necessary that the operator follow the machine and maintain control over some distance, such as in the operation of small overhead cranes.

Pendant pushbutton stations are excellent for this application. The pendant station is suspended on a chain from the moving machine. Standard pendant stations have three to ten units. The standard Stop unit is a wobble stick extending from the bottom of the unit.

ENCLOSURES

According to JIC Standards, pushbutton control must be dust, moisture, and oil tight, and installed in a metal enclosure. In many industrial applications pushbutton failure is often due to contact clogging by oily grime and foreign material. Operation is interrupted and pushbutton life is shortened. Oil-tight construction seals out foreign material to make the units suitable for a variety of applications. Oil-tight units are widely used wherever the operator's hands or gloves are oily or dirty. This oil-tight construction also protects the contacts.

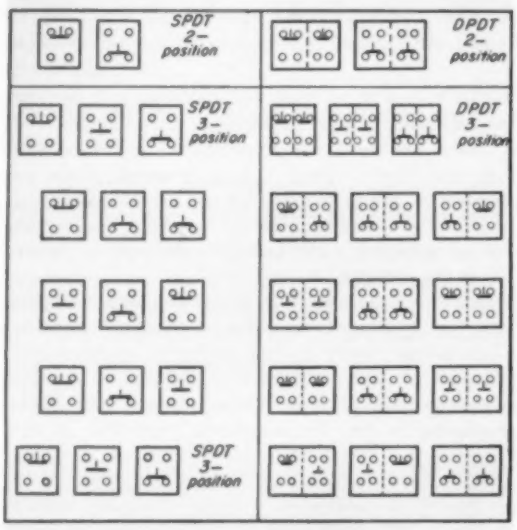
JIC Standards require that the units have treated leather or composition diaphragms between the operating button and switch mechanism. However switches without diaphragms are acceptable if they are dust, moisture, and oil tight.

Standard cast enclosures are available for mounting from one to sixteen units. The units may also be mounted on a panel for integral installation on a specific machine. For special jobs, custom panels mount many more units. A cover gasket makes the enclosure oil-tight. Special enclosures are available for hazardous locations.

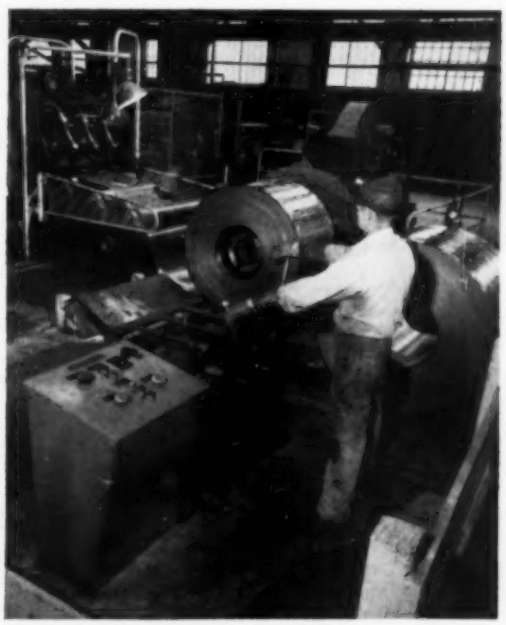
INSTALLATION

JIC Standards state that all Start switches shall be mounted above or to the left of the associated Stop button, although this does not apply to Start switches whose location is prescribed by safety considerations such as on clamping equipment. Emergency Stop pushbutton switches must be of the palm or mushroom type. In addition to a clear nameplate, emergency Stop switches should be red and return switches should be yellow. Palm or mushroom switches should not be used as start switches, unless two are mounted in series for operation by two hands. All pushbutton switches should be readily accessible and should be mounted so that the movement is horizontal.

Oil-tight pushbuttons consist of an actuator and a contact block. These can be obtained separately



SELECTOR SWITCH ARRANGEMENTS. In addition to these arrangements, the switches can be spring returned to mid-position from both sides or from one side only.



CONTROL STATION for reel control equipment includes manually operated valves and pushbutton control pedestal. Large mushroom head switches are for emergency and stop operations.

or as an assembly. Each contact block contains single-pole, double-throw contacts, double break with one normally open and one normally closed set of contacts. As many as four contact blocks can be assembled in one pushbutton unit. Because of the separate construction of the actuator and contact block, in some installations, the actuator may be mounted on the cover of a box with the contact blocks mounted inside the box. When the box cover is closed, the actuator is in proper position with respect to the contact block. This makes a very neat installation with no wiring between the inside of the box and the cover.

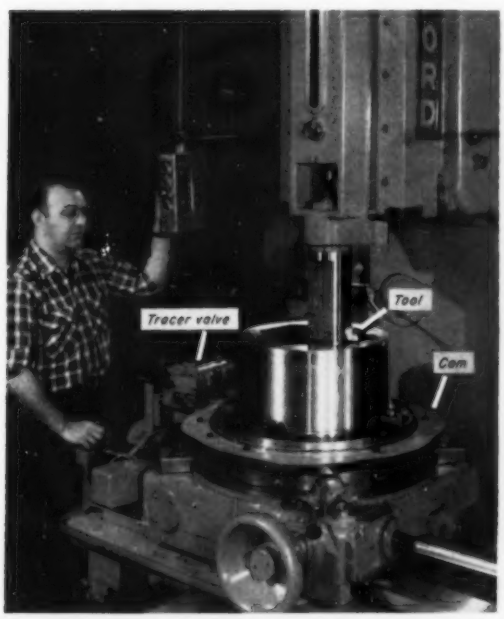
ELECTRICAL RATINGS

A-c contact ratings for standard pushbutton switches are 6 amperes on 110 volts, 3 amperes on 220 volts, 1.5 amperes on 440 volts and 1.2 amperes on 550 volts. Inrush current ratings are ten times normal current. Maximum allowable continuous current is 10 amperes, however the contacts should not be opened at currents in excess of normal current ratings. D-c contact ratings are 2.2 amperes on 115 volts, .55 to 1.1 amperes on 230 volts, and .2 to .4 amperes on 550 volts.

PUSHBUTTON TYPES

In addition to standard, momentary contact units, maintained contact pushbuttons are available for applications where the contacts must remain closed. These units consist of two actuators and a toggle mechanism to hold the contacts in either position. To change contact, the opposite pushbutton must be pressed.

Pushbuttons with key locks are supplied for many different locking requirements. Units are available to lock with or without the key inserted. One manufacturer has six types of standard, key-lock pushbutton units. In type *a* the unit can be operated normally without the key inserted and can be locked in the normal position. In type *b* the unit can be operated normally without the key inserted and can be locked with the button fully depressed. In type *c* the unit operates normally without the key inserted and can be locked in either normal or depressed position. In type *d* the pushbutton can only be operated with the key inserted in the lock. It can be locked only in the normal position. In type *e* the pushbutton can be depressed without the use of the key but can only be released with the key. The unit can only be locked in the depressed position. In type *f* the pushbutton can only be operated with the key inserted in the lock and can be locked in either normal or depressed position. Padlock attachments may also be used with either guarded or mushroom pushbutton actuators to permit locking of the button in the depressed position.



PENDANT STATION on this vertical slotter permits the operator to follow the machine through its motions in three directions: longitudinal, cross, and rotary. Rockford Machine Tool Co.

SELECTOR SWITCHES

Selector switches are similar to pushbutton units in construction and installation and are usually mounted with the pushbuttons on a panel. Two and three-position switches are available with single-throw and double-throw contacts.

Instead of the normal lever, the selector switch may have a slot for coin operation to reduce the possibility of accidental operation. A wing lever can also be provided for the selector switch permitting quick easy operation, even when the operator is wearing heavy gloves. Key locking selector switches prevent accidental operation and can be locked in any or all positions.

COMBINATION UNITS

Units which combine the functions of a selector switch and a pushbutton switch are referred to as selector pushbuttons. The selector switch actuator is usually a guard around the pushbutton. This guard can be turned to give the equivalent of a two-position selector operation. A typical application of this type of switch is for a start-jog requirement. The pushbutton is used to start the operation in either automatic or jog operation. However when the selector ring of the unit is placed in jog position, a holding circuit is broken, and the circuit is energized only when the pushbutton is depressed.

INDICATOR LIGHTS

Indicator lights for panel mounting have synthetic seals to make them oil resistant. One type uses seals between the glass lens and mounting fix-

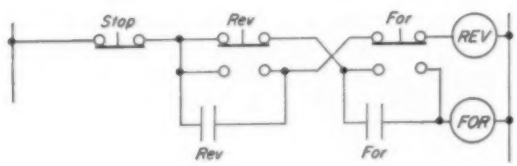
ture, between the lens cap and light unit, and between the panel and light. Three types of indicator lights are generally used depending on the power source and operating conditions. For applications where an appreciable amount of vibration is present, where the unit is subjected to mechanical shock, or where long life and low maintenance is desired, a transformer type light using a 6-volt bayonet-base bulb should be used. These transformer type indicator light units can be supplied for use on 110, 220, 440, or 550 volts; 25, 30, 50, or 60 cycles.

For direct current applications or for use on applications where a shock resistant construction is not required, a full voltage type indicator using a 110, or 220-volt incandescent screw-base bulb should be used. When it is required to cut maintenance costs to a minimum, the transformer type indicator light is recommended for all machine tool applications using a-c power, because of its shock resistant construction. On d-c applications, full voltage type indicator lights must be used.

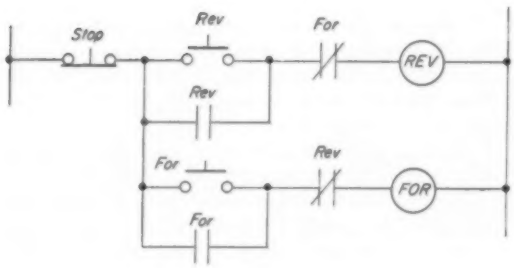
Where ruggedness and low cost are important considerations, an indicator light construction using a neon bulb is also available. ▼▼▼

In February Part II of this article will present circuit ideas for applying pushbutton control.

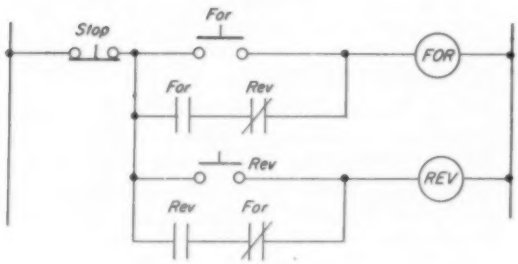
4 WAYS TO ACTUATE 2 RELAYS



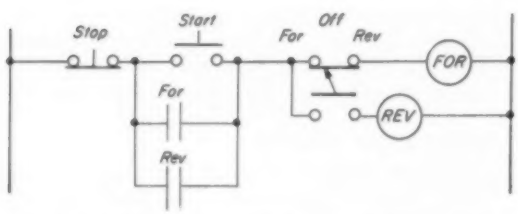
1 By putting the forward and reverse switches in the actuating circuits of the opposite relay, the circuit ensures that only one relay is actuated at a time. Simultaneously actuating both pushbuttons has no effect. It is not necesary to depress the Stop switch before actuating the Forward or Reverse switch. The circuit requires six leads to the pushbutton control station.



2 Wiring to the pushbutton station can be reduced to 4 leads in this circuit. However it is necesary to actuate the Stop switch before depressing either the Forward or Reverse switch. At least three sets of contacts are required for each relay. Simultaneous actuation of both pushbuttons will not energize both relays if one picks up slightly before the other.



3 Operation of either the Forward or Reverse switch opens contacts in the holding circuit of the opposite relay de-energizing that relay. However actuation of both switches at the same time will energize both relays. If both switches were held down, both solenoids of a valve would draw inrush current continuously and would soon burn out. The circuit does not require that the Stop switch be actuated before either the Forward or Reverse switch is actuated. Four leads to the pushbutton control station are required.



4 Using a 3-position selector switch, only one Start switch is required. In the Off position of the selector switch, neither relay can be actuated. If a two-position selector switch is used, it must be of the break-before-make type to protect against both relays being energized at once. Single pushbutton switch for energizing either relay may be a safety hazard on some applications.

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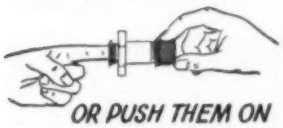

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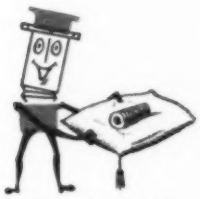

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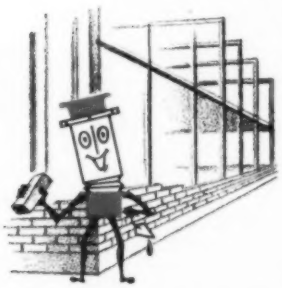

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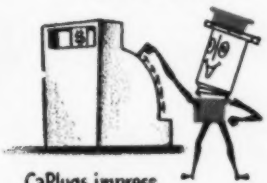

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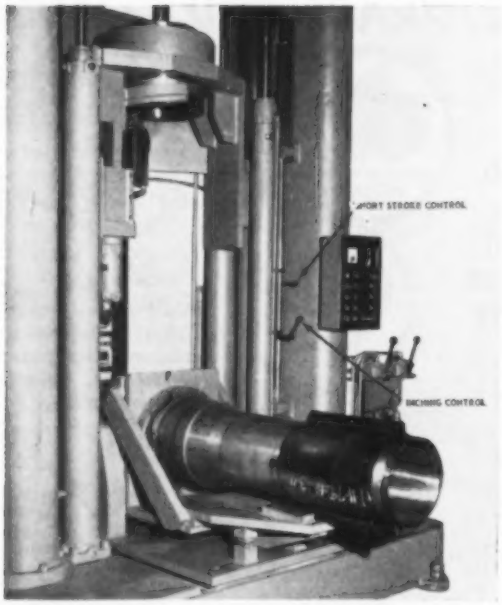


WORK FIXTURE will be tilted upward from this load position. To simplify piping, the heavy duty, hydraulic cylinders and the air operated counterbalance cylinders are manifolded to the base and machine columns.

BORES up to 20 inches in diameter and 76 inches long are honed on this machine. Tool reciprocation is controlled by manual adjustment of pump delivery.

• By R. C. Engle

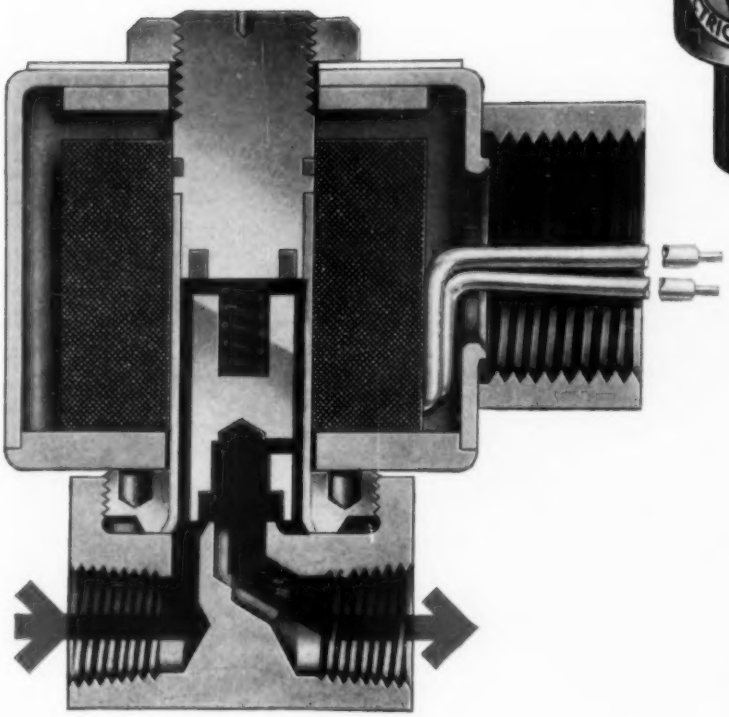
CONTROL of tool reciprocation on a large, heavy duty, vertical honing machine is obtained with manual and solenoid valve operation. This twin column machine, Micromatic Hone's model 480, is designed for heavy stock removal in bores up to 20 inches in diameter and 76 inches long.

Because of the wide range of bore diameters and the different materials being honed, simple variable control of speeds and pressures is required. Manual adjustment of delivery from a radial piston variable volume pump provides a wide range of speeds for tool reciprocation. Weighing 2300 pounds, the honing head can be reciprocated at speeds up to 70 fpm when the full 34.4 gpm pump volume is delivered. The pump used on this machine includes an integral, low pressure gear pump which operates pilot valves, clamps and the work positioning fixture.

Smooth inching of the tool is one major requirement of this type of machine tool. Designers of

R. C. ENGLE, *Honing Machine Design Supervisor, Micromatic Hone Corporation, Detroit, Michigan*

actual size



New C-series solenoid valve offers recognized "Skinner Quality" at low cost

This is a faithful reproduction – in miniature – of the time-tested, 2-way, normally closed Skinner V5 except that the body is made of brass.

This new, compact Skinner valve weighs only 12 ounces, yet it's rugged enough to last millions of cycles on most applications. It is a packless, direct-acting valve with only two moving parts. And it's absolutely bubbletight – even on vacuum. This C-Series Skinner valve is failproof, too – positive closing is assured by a spring return. It can be mounted in any position and is ideal for direct-line mounting.

You'll find this new valve, with its recognized "Skinner Quality," the perfect low-cost answer to a wide range of flow control problems. It works efficiently with air, water, oils, gasoline and many other media. Typical applications include: automotive fuel systems, welding equipment, vending machines, lubricating devices, spraying equipment, air horns, water softeners, humidifiers and instrumentation.

Our Bulletin D11.1 contains complete information on this valve – flow curves, optional features, dimensions, electrical data, etc. We will be happy to send you a copy on request.

SKINNER ELECTRIC VALVES

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Circle 122 on Reader Service Card

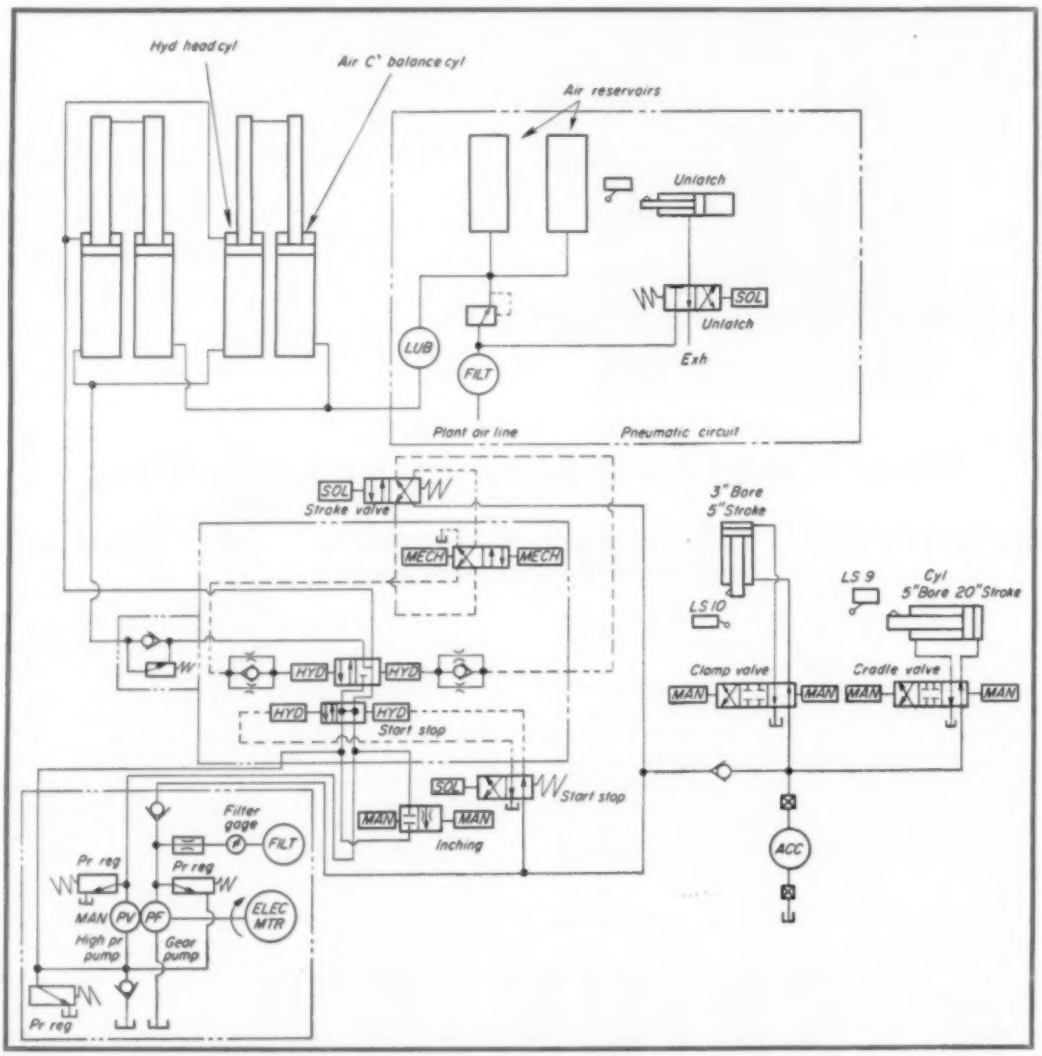
SEMI-AUTOMATIC HONING CIRCUIT

this circuit developed a manually operated inching valve having built in throttling action to give the operator positive control of the head when lowering the tool into the work. This normally closed valve is inserted in the circuit to provide bleed-off control when inching is desired. It eliminates the jerking which is often experienced when a solenoid operated quick-opening inching control is used. The operator uses the inch valve during set-up, when changing abrasives, or for emergency stops.

Safety interlocking with limit switches permits starting operation of the honing cycle only after the work piece is properly clamped and positioned.

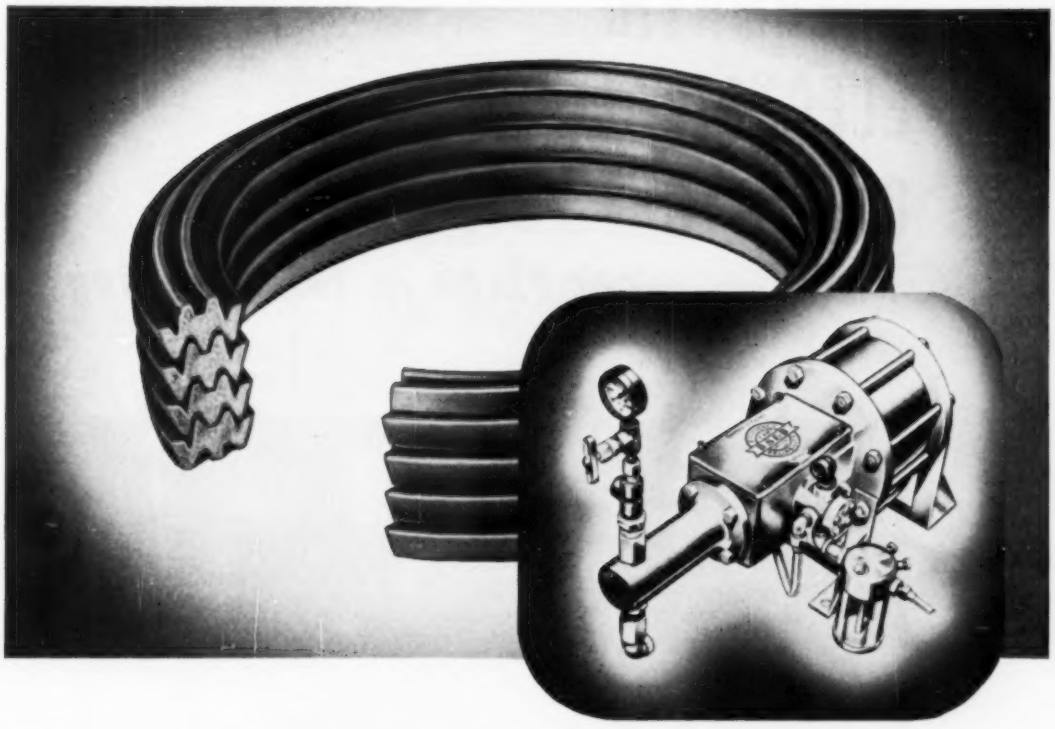
Counterbalancing the 2300 pound reciprocating, vertical head is another design consideration for which the engineers chose a compressed air circuit. Two, 15,551 cubic inch air reservoirs are used. Sizing the counterbalance system is based on an air pressure of 30 psi and an 8 to 10 percent rise in pressure as air is pushed out of the counterbalance cylinders back into the reservoirs.

Stroke control is provided by adjusting the spacing of dogs which mechanically reverse a pilot valve to cause hydraulic reversal of the main directional control spool. Smooth reversing action of the head is obtained by deceleration and acceleration needle valves in the pilot lines of the main spool. ▼▼▼



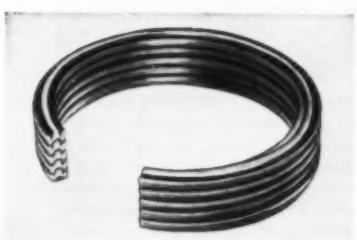
HYDRAULIC power is used for honing tool reciprocation, and for part positioning and clamping. Counterbalancing the weight of the tool head is done with an air circuit.

J-M Uneepac® does it again!



"Very satisfactory sealing service against wide variety of fluids and pressures up to 5,500 psi"

says Black, Sivalls and Bryson, Inc. makers of BS&B Glycol Pump



Uneepac comes in two types. Shown here is design for flange widths up to ½" which is used in BS&B Glycol Pump. Large illustration above shows design for flange widths over ½".

Chalk up another success story for Uneepac—Johns-Manville's automatic ring packing. In the BS&B Glycol Pump, fluids handled include triethylene glycol, diethylene glycol, gasoline, and various types of oils, alcohols and petroleum treating chemicals. Working pressures range from 125 psi to 5,500 psi with average operating pressures at 3,000 psi. Yet despite these rugged service conditions, Uneepac has delivered—in Black, Sivalls and Bryson's own words—"very satisfactory service."

Many other packing users have acclaimed J-M Uneepac for its long, trouble-free service. Each ring is a complete packing unit. Fewer rings are needed than ordinarily required and stuffing box size can be reduced to the minimum. Each ring centers itself automatically on the preceding ring to simplify installation. This exclusive design also permits fluid pressure to act upon each lip individually and protects lips from excessive gland pressure.

J-M Uneepac comes in a wide range of styles and sizes for many rod and plunger applications. For further information write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

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HYDRAULIC PNEUMATIC ELECTRICAL CIRCUITS

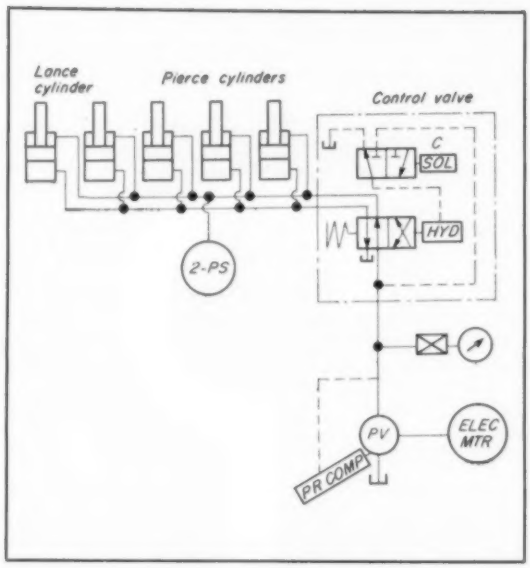
... combined in this piercing tool

• By John Foy

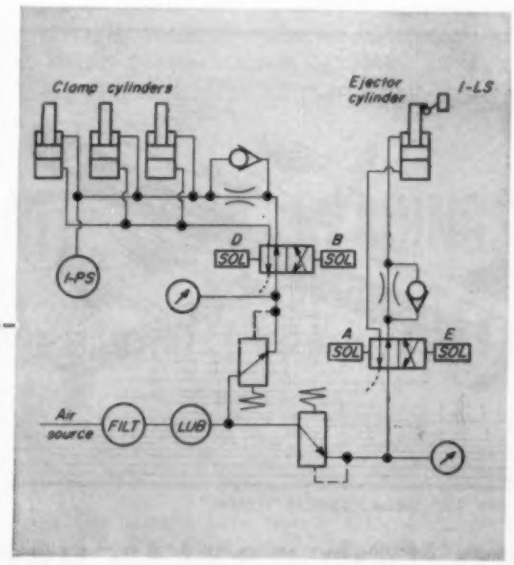
AUTOMATIC WASHING MACHINE tub is manually loaded on tool. Three air cylinders clamp workpiece. Four pierce cylinders and a lance cylinder are actuated when mushroom-head pushbuttons are pressed.

TO speed the piercing of tubs for automatic washing machines, Whirlpool-Seeger Corp. has engineered a special tool using air clamping, oil piercing, and electrical control. The frame of the machine is constructed so that the tub spindle is at an angle for easier manual loading. A pushbutton station is mounted on an arm over the equipment and contains six pushbuttons to start the pump motor, clamp the unit, extend the piercing cylinders, and retract the ejector cylinders. Other movements are initiated either by pressure switches or pneumatic timers.

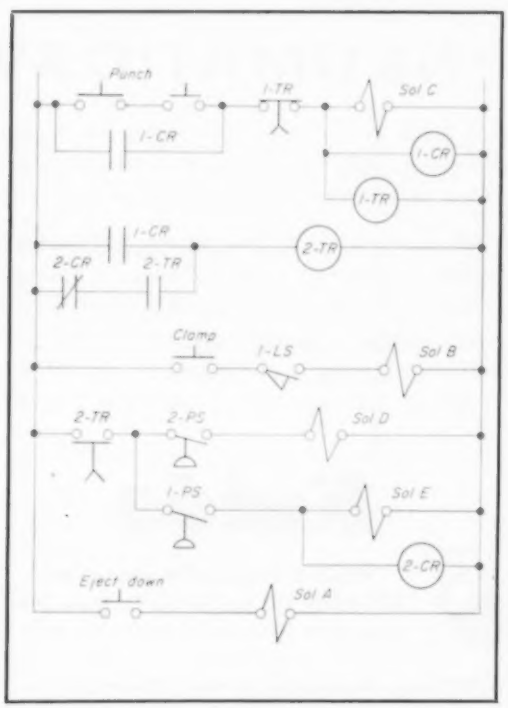
John Foy, Manufacturing Engineering, Whirlpool—Seeger Corp., Clyde, Ohio



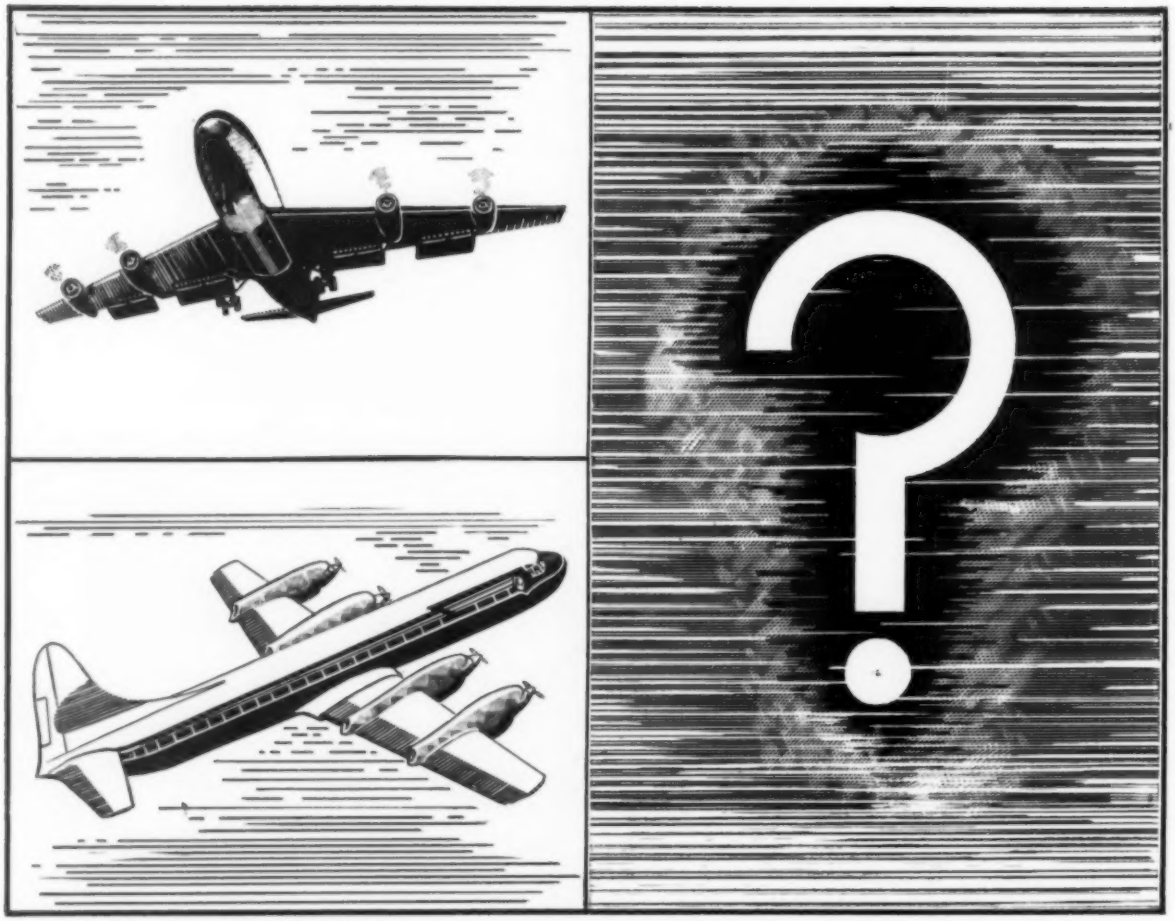
HYDRAULIC CIRCUIT. Lance and pierce cylinders have positive stops mounted on rods to limit extension. When cylinders are fully extended, pressure-compensated vane pump moves to near no-delivery position.



PNEUMATIC CIRCUIT. Clamp cylinders and ejector cylinder are controlled by 4-way, solenoid valves. When clamp cylinders are fully retracted, air pressure actuates 1-PS. When ejector cylinder is fully retracted, it actuates 1-LS.



ELECTRICAL CIRCUIT. Before tub is loaded, EJECT DOWN button is pressed energizing solenoid A to retract the ejector cylinder. Limit switch 1-LS is then closed. Tub is loaded and CLAMP pushbutton is pressed energizing solenoid B and extending the three clamp cylinders. PUNCH pushbuttons are then pressed energizing solenoid C, relay 1-CR, and timer 1-TR. Relay 1-CR energizes timer 2-TR. Solenoid C extends piece and lance cylinders performing the required operation. When 1-TR times out solenoid C is de-energized retracting the piercing cylinders. When 2-TR times out, solenoid D is energized through pressure switch 2-PS which is actuated when pierce cylinders retract. Clamps retract and 1-PS closes energizing solenoid E to eject tub. Relay 2-CR is also actuated resetting 2-TR for another cycle.



Top: BOEING "707" Bottom: LOCKHEED "ELECTRA"

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HOW TO GET ACCURATE FLOW READINGS

. . . when testing aircraft components

• By William M. Richner

Errors in flow measurement cost aircraft manufacturers and suppliers many dollars in rejected parts and testing time. To obtain reliable measurements when using a variable-area flowmeter, a calibration curve for each fluid is needed.

AS aircraft hydraulic systems have become more complicated and critical, fluid flow rates and consequently flow measuring devices have become increasingly important. Many hydraulic components being used and tested by aircraft companies and their suppliers have narrow flow tolerances which require a high degree of measuring accuracy for proper evaluation of hydraulic performance.

The generally accepted flow measuring device in the aircraft hydraulic field today is the variable-area flowmeter, sometimes called a "rotameter". This instrument is being widely used in the aircraft industry with the assumption that its accuracy is dependent only upon the initial calibration of the tube at the factory. This assumption is not necessarily true and is likely to lead to highly inaccurate flow measurements, especially in the lower flow ranges. Some method or program for eliminating these flow measuring errors is highly desirable.

Why a variable-area flowmeter is subject to errors? When the flowmeter manufacturer calibrates the meter at his factory and engraves the tube scale, he uses a fluid having certain known physical properties (usually specified by the purchaser). For hydraulic oil, these are normally viscosity and specific gravity. Since the variable-area meter is sensitive to changes in these properties, its guaranteed accuracy is valid only when the instruments is used with a fluid having these same exact physical characteristics. The calibration fluid properties are usually engraved on the tube and are referred to as the "scale properties". When the manufacturer

WILLIAM M. RICHNER, *Research Engineer, North American Aviation.*

speaks of the accuracy of this instrument, he is referring to the accuracy obtainable when measuring a fluid whose properties correspond to those specified on the scale. The use of this meter must then adjust his test fluid characteristics to duplicate the scale properties if the specified accuracy is to be obtained. If he does not, he can expect variations from the true flowrates as large as 50 per cent in some cases.

It is very impractical and, in some cases, impossible to duplicate these scale conditions in the fluid passing through the meter. Difficulty in controlling oil properties becomes apparent when several characteristics of MIL-O-6083 and MIL-O-5606 hydraulic fluids used in aircraft hydraulic testing are known:

1. Viscosity and specific gravity of petroleum oils vary considerably with changes in temperature. Close thermal control must be maintained in order to obtain consistent values.
2. Viscosity-temperature relationship of the two aircraft hydraulic oils varies somewhat among different batches of the same fluid. Military procurement specifications require a minimum viscosity at 130 F but no upper limit has been established. Consequently, variations in this property can, and do, exist among different batches of new oil at the same temperature.
3. This same viscosity-temperature relationship will change quite markedly in a test stand as the fluid is used, especially under high pressure conditions (3000 psi).
4. Although specific gravity does vary with temperature, the manner in which it varies does not change appreciably among different batches nor with use.

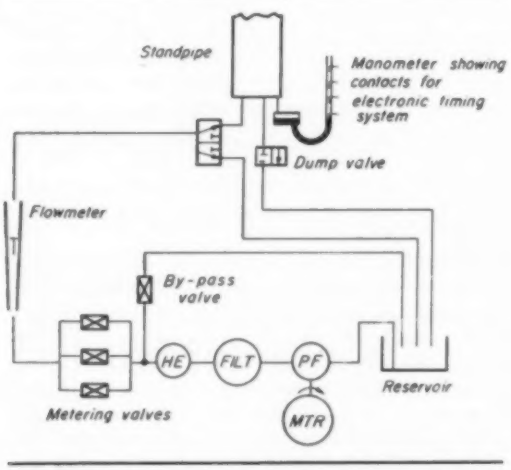

FIG. 1. Gravimetric system for flowmeter calibration uses a mercury manometer.

These inconsistencies make it almost impossible to match the two scale properties simultaneously at any given time in a flowmeter. However, this does not mean that the variable-area flowmeter cannot be used to measure fluids with properties other than these stated on the scale. The calibrated accuracy can be easily obtained over a large range of fluid properties by constructing curves which indicate true flow rates with changing physical properties. The preparation of these calibration curves, their proper use, and their maintenance should be the product of a well-planned calibration program.

CHECKING VOLUMETRIC FLOW

Since a calibration will consist of accurately determining the flow through a meter with changes in oil properties, the first major item to be concerned with in setting up a program will be how these true flowrates can be obtained. There are many methods in common use for checking the volumetric flow of a liquid through a flowmeter.

"Bucket and stop watch" method. This procedure involves collecting the fluid discharging from the flowmeter in a graduated container and timing the operation with a stop watch. The accuracy of the results is dependent upon human reaction time and is, therefore, very unreliable. This method can be refined by starting the timer and the flow by electronic means. The graduated container can also be replaced by a precisely calibrated burette which is necked down at the reading points so that the liquid traverse is rapid. In addition to these improvements, if the temperature is controlled very closely so that the fluid properties are maintained at specified values, accuracies of ± 0.25 per cent are obtainable under these conditions.

Comparison method. Calibrations are made by connecting the unit to be calibrated in series with a master precision meter for which accurate calibration curves are available. Fluid viscosity information for the test fluid and for the master scale calibration fluid must be available in order to correlate the readings. This process merely transfers a calibration and is not used where a high degree of accuracy is required. Errors in maintaining consistent temperatures plus reading errors do not yield accuracies much better than ± 2 percent.

Gravimetric system is one of the most accurate methods of flowmeter calibration. A vertical standpipe and a mercury manometer are used. The liquid weighing apparatus is completely free of levers, linkages, friction, and evaporation effects. A schematic diagram of the device is shown in Figure 1. The manometer containing probes which act as electrical contacts with the mercury is connected to the bottom of the standpipe. During the calibration procedure, liquid flow passes through the flowmeter being calibrated into the standpipe, the cross-sectional area of which is precisely known. As the mercury rises in the manometer due to the weight of the liquid, it starts and stops an electronic timing

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device. The weight-rate of flow is obtained by multiplying the pressure represented by the distance between the contacts by the standpipe cross-sectional area and dividing this product by the elapsed time.

The weight-rate of flow is determined by comparing this weight to the elapsed time for the mercury to traverse the distance between the contacts. Conversion to volumetric flowrates is easily accomplished by knowing the specific gravity of the liquid flowing through the meter at the time the reading was taken. Calibrations made by this method are independent of density changes of the liquid to the same extent that any weighing of a liquid is independent of density. This system was developed by the Fischer & Porter Company and it is claimed that accuracies of ± 0.1 percent are obtainable.

Another weight-rate method of calibration utilizes a tank mounted on a precision scale and an electronically controlled weight-timing device. During the calibration procedure, the flow from the flowmeter is diverted into the tank and the time for a predetermined weight of fluid to flow into the tank is measured.

A schematic diagram of this system and a photograph of a typical machine are shown in Figure 2. This calibration stand has been giving excellent service with consistent accuracies of ± 0.2 percent.

It was considered to be the most practical for use from the standpoint of accuracy, initial cost, and operating expense. It should be added that there are several other variations of the weight-rate system of calibration, however, they only differ in the method of weighing the liquid.

Regardless of the calibration system which is to be used, the apparatus chosen should have the following minimum features:

1. An easily accessible and convenient method of attaching the flowmeter to be calibrated.
2. A flow capacity which will accommodate all flowmeters in use or contemplated for future requirements.
3. Adequate means of controlling the liquid temperature within 0.2 F.
4. Sufficient metering valves to allow for precision flow control.
5. A precise, automatic timing device with provisions for controlling power line frequency, if necessary.

Calibrated flow information for a flowmeter can be obtained from commercial laboratories. However if the economics of this procedure is investigated, it is believed that most companies will prefer to purchase their own calibration device.

PLOTTING THE CURVES

It has been found by experience that the simplest and most practical method of presenting the calibration information consists of plotting flowmeter scale readings against actual flow at various viscosities and corresponding specific gravities. Figure 3 is an illustration of a calibration graph of this type. It has been found that in most cases it is necessary to obtain actual flow information at only three viscosities. If these points are sufficiently separated,

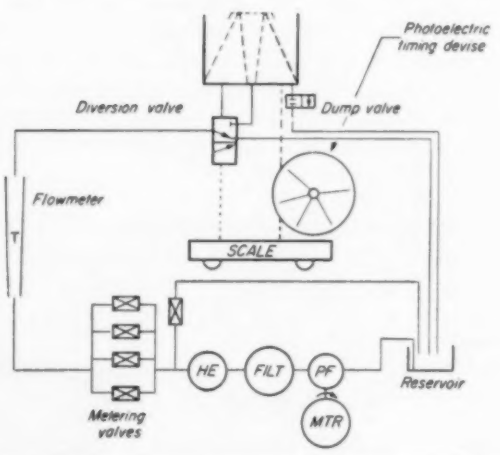

FIG. 2. Electronically controlled weight-timing device is used in this setup. Photo on left shows completed test stand which includes all components in the circuit shown below.

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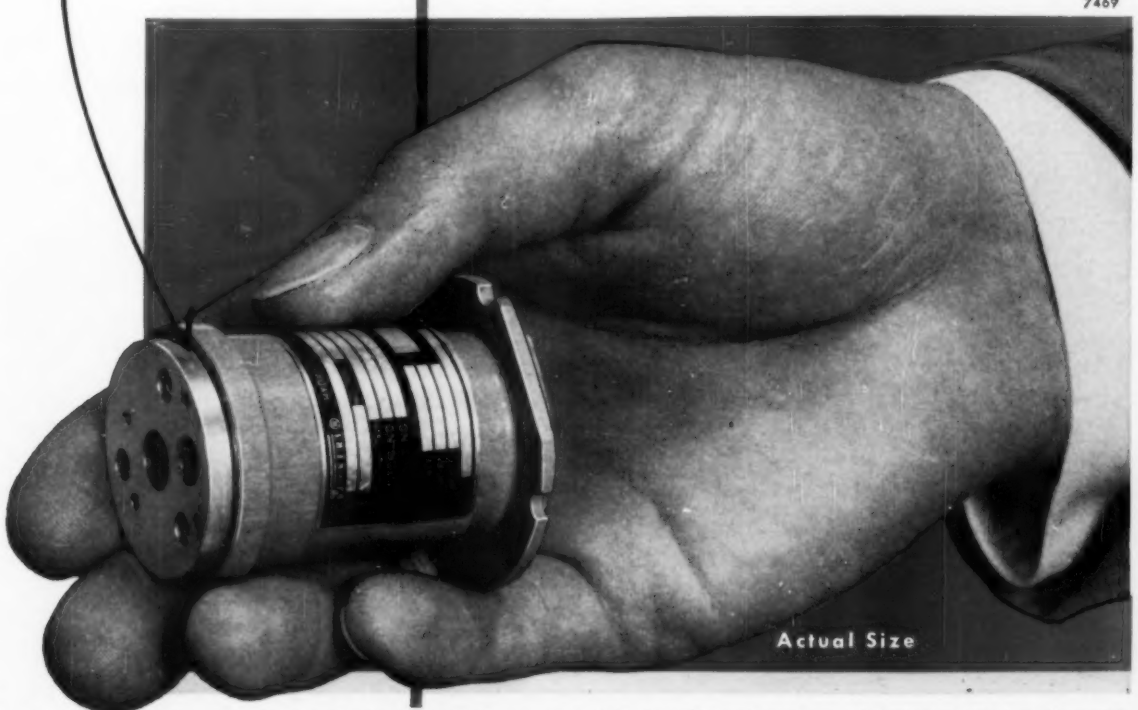


A large expansion program now in its early stages means large opportunities for additional engineers at Vickers. Write for information.

they will define the curves within acceptable limits. The use of these curves consists of entering the abcissa at the test fluid viscosity, following this viscosity line up until it intersects the flowmeter scale indication and reading the actual flow on the left ordinate. The calibration curves must be plotted against a sufficiently large viscosity base in order to cover the anticipated test temperature range.

Values of specific gravity for the fluid used in calibrating the meter are plotted on a secondary scale. They are recorded immediately beneath their corresponding viscosity values. If the density of the test fluid varies appreciably from that of the calibration fluid at the same viscosity, a correction can be applied by the following formula which is derived from the basic flow equation for the variable-area flowmeter:

$$\text{Correction Factor} = \sqrt{\frac{(P_f - P_{w2})\,P_{w1}}{(P_f - P_{w1})\,P_{w2}}}$$

Where: P_f = Density of the flowmeter float
P_{w1} = Density of the Calibration fluid
P_{w2} = Density of the test fluid

Density corrections are not normally needed for the great bulk of aircraft hydraulic testing and can usually be neglected unless very close accuracy is desired.

Since the calibration procedure and the use of the curves is primarily concerned with viscosity changes, some method of determining hydraulic oil viscosity must be available. This information can be obtained at commercial laboratories, but again it is believed that most companies will find it more economical to purchase a viscometer for their own use. Figure 4 shows a viscometer of the modified Ostwald type which has been found to be satisfactory for this work. A curve of test fluid viscosity vs. temperature must be furnished with each calibration graph in order for the calibration information to be usable. The program must also make provisions for revising these viscosity curves periodically to account for changes due to the addition of new oil or viscosity breakdown with use.

Accurate means for measuring the temperature of the test fluid at the flowmeter must also be available. Thermocouples inserted into the inlet connections to the flowmeters are considered to be the most practical for most aircraft hydraulic testing. While dial thermometers have sufficient accuracy, they will not respond quickly to temperature changes in the oil.

All flowmeters should be recalibrated at specified periods depending upon their use and application.

MAINTAINING AND USING THE INSTRUMENTS

These points are important in maintaining and utilizing calibration information and should be

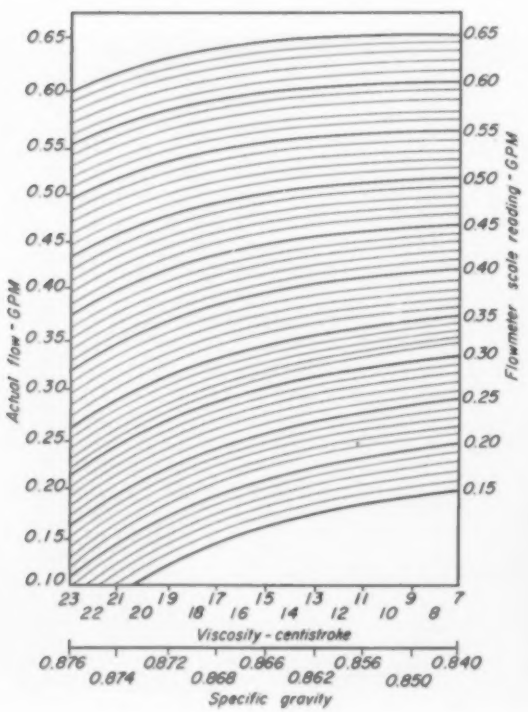
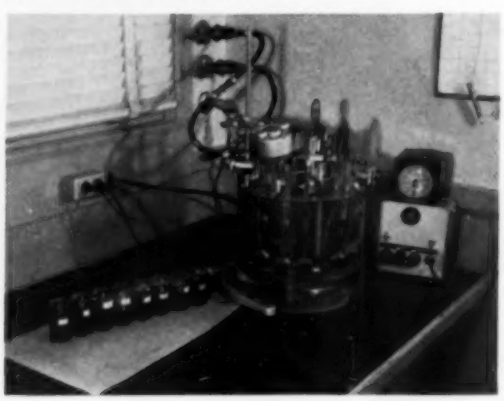


FIG. 3. Typical calibration graph for accurate flow measurement.

FIG. 4. Modified Ostwald type viscometer is used to determine oil viscosities which must be known to establish flow calibration.



stressed in any instructions to the people using the meters:

1. The proper reading edge of the float should be used in recording flowrates. This edge can be illustrated on the calibration graph. Disagreements in flow results have often been found to be due to misunderstandings as to where the various floats should be read.
2. Hydraulic fluid containing air bubbles should not be measured. Air effects the fluid properties and introduces a substantial error.
3. The float in a meter with bead guides should not be allowed to vibrate against the tube beads. This condition occurs quite often in this type of meter and if allowed to continue, will damage the float edge and the tube.
4. Flowmeters should not be jarred or handled roughly as this can result in damage to the float and/or the tube.

It has also been found that a written procedure on the use of the calibration curves should be presented with each graph. This procedure explains simply how to use the curves and the density correction formula. This procedure also explains briefly why the calibration curves are necessary.

A flowmeter calibration program similar to the one outlined in this article has been operating satisfactorily for some time. It has resulted in large savings due to fewer disagreements in flow results and consequent unnecessary rejections of badly-needed parts. Savings resulting from the program more than balance the cost. ▼▼▼

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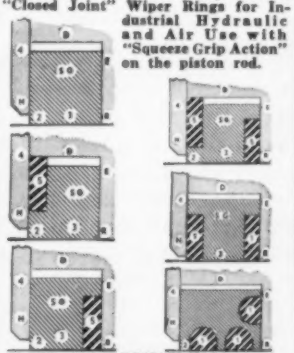

RING DESCRIPTION
SG—Indicates "Squeeze Grip."
2—Front side of ring.
3—Closed joint is in ring.
4—Flange (or plate) holds ring in cavity.
5—Rubber seal compressed in restricted area.
H—Inside dia. of flange at bevel end (see #4 above).
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E—I.D. of cavity for holding ring.
R—Ring I.D. and/or rod O.D.

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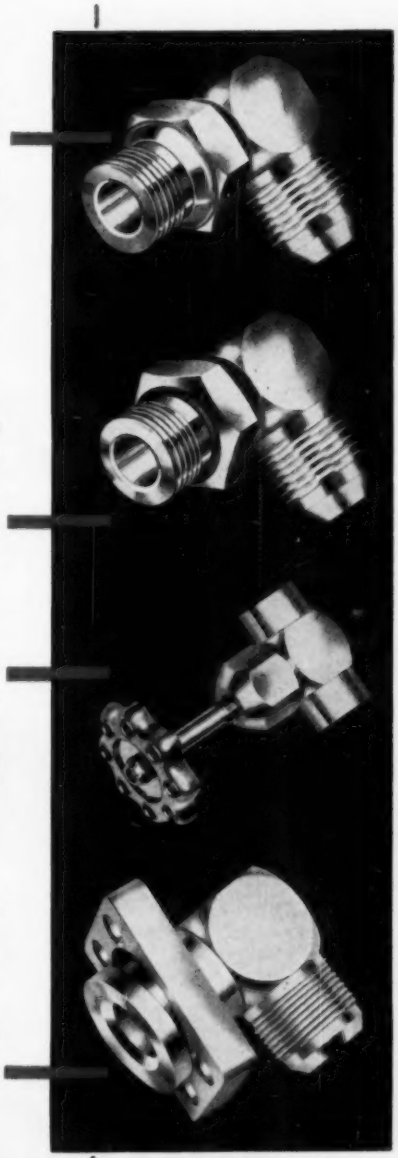

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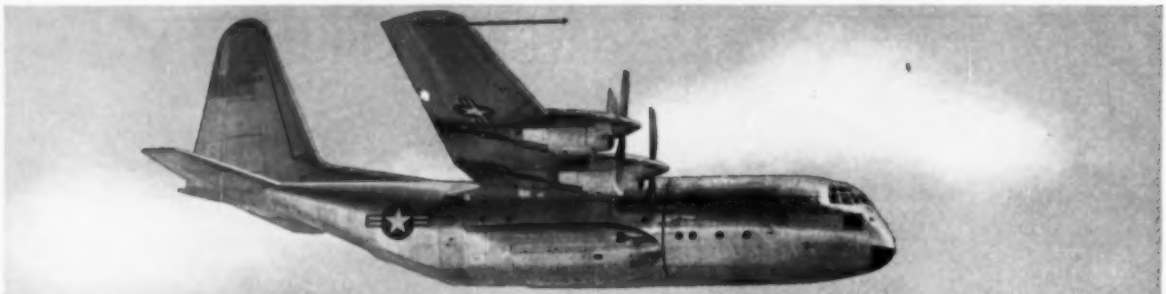
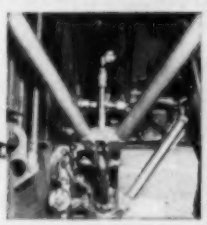


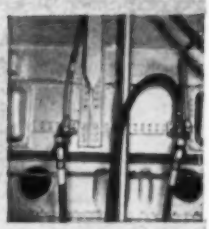
LOCKHEED ELIMINATES TIGHT BEND RADII

WITH CHIKSAN SWIVEL JOINTS



Installed on the nose wheel assembly of the P2V-7, Chiksan Swivel Joints eliminate tight radii bend in rubber hose.

Chiksan Swivel Joints on landing gear of Lockheed's Constellations give metal hydraulic lines the flexibility of rubber.



Located in the landing gear housing of the C-130 these Chiksan Swivel Joints conserve system space, lengthen hose life.

"Better check with Chiksan." That phrase is almost a byword with Lockheed design engineers when the problem of tight bend radii develops. For good reason, too. Lockheed engineers have found time and again that Chiksan has the experience and the facilities to provide a compact lightweight swivel joint to meet their needs quickly, efficiently. Check with Chiksan. Remember that phrase the next time you want a fast, right answer to your bend radii problem.

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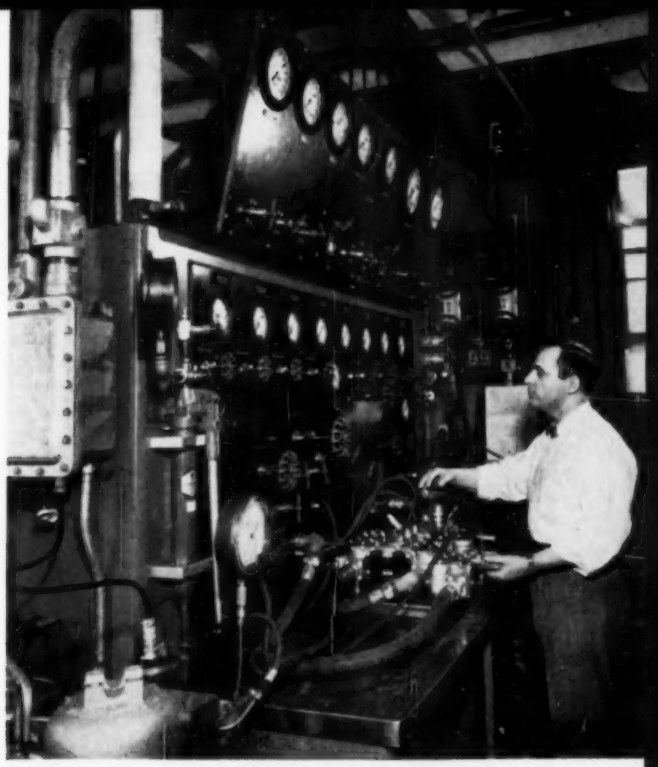


COMPONENTS AND CONTROLS are tested on this bench.

FLUID MOTORS COMBINE WITH ANALOG COMPUTER

... to test jet controls

Fluid motors and an analog computer are combined in a lab to simulate operation of a jet engine. Controls and finished parts are tested. Problems and expense of test runs on an engine test cell are avoided.

• By Robert G. Butterwick

MANUFACTURERS of automatic controls for jet engines find it difficult to test their design ideas and finished parts. The ideal method is by actual test-run on an engine. However, it is an expensive proposition for a company, not in the engine business, to build a completely instrumented engine test cell. Also, a serious problem would be created by the noise attendant to operation of the engine.

An alternative is to ship the control to the engine manufacturer's plant, and send along the necessary engineering personnel for the tests. This way is also expensive, as it ties up both valuable engineering time and the control. Another drawback is that design changes would have to be decided at long distance, with resulting delays and possible misunderstandings.

The Aeronautical Division of Minneapolis-Honeywell Regulator found an answer to the problem. Their engine controls personnel are regularly running tests on late models of jet engines, and the "engines" do not make a sound. In fact, there aren't any engines. It's all done with electronics and hydraulics.

The analog computer simulates the performance of the "ghost" engine. Performance data and other engine characteristics are received from the engine manufacturer and simulated on the computer. This data is then reproduced as electrical signals which run the engine controls.

While the computer can simulate engine performance, and even engine control, if necessary, it cannot simulate fuel. A control cannot run dry, even while

ROBERT G. BUTTERWICK, *Service Engineering (Aeronautical Division) Minneapolis-Honeywell Regulator Co., Minneapolis Minn.*

operating from a "ghost" engine. Here's where the oil hydraulic system comes in.

For example, two pumps are used as prime movers for fluid motors. In turn, these motors drive fuel pumps which deliver fuel in the hazardous fuel flow bench area where precautions against explosion of vapors are mandatory.

Each unit is controlled by a balanced bridge servomechanism, consisting of an amplifier, pilot valve, torque motor and hydraulic actuator. The control is necessary because in an actual installation the aircraft fuel pump responds directly to changes in engine speed.

COMPUTER operator checks results and can control all operations in the flow bench area by means of the console under the window.

Advantages of a "Ghost" Engine

1. Economy—Cost of the lab is less than that of a single engine test cell. Fuel is saved. The computer never gets thirsty and always returns the fuel to the tanks.

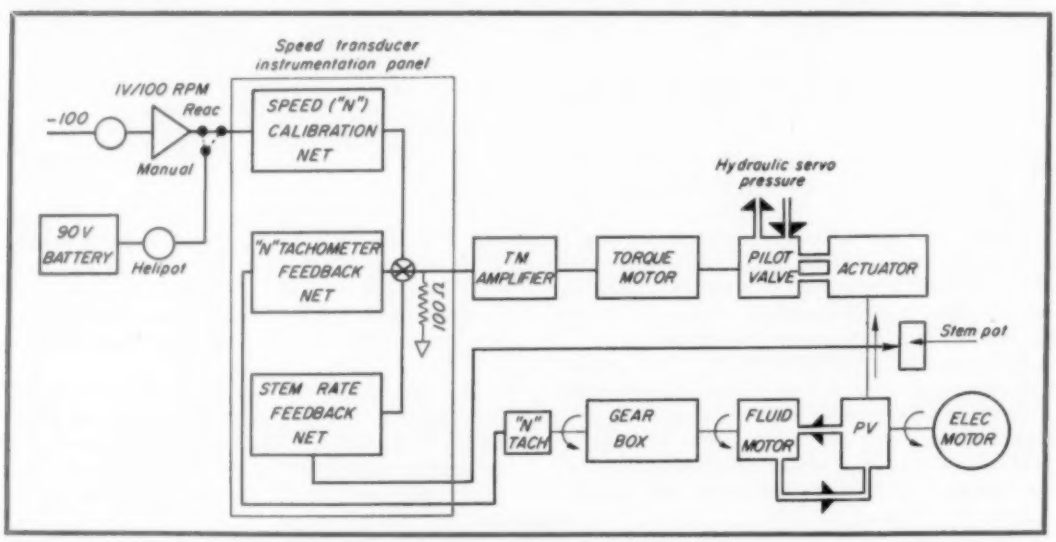
2. Flexibility—Changes in both engine and control design can be handled quickly and easily. Either the complete control or sections of it can be tested without much trouble.

3. Reliability—Under actual operating conditions it is virtually impossible to exactly duplicate conditions from one operating test to the next. This is a simple matter with the computer. Also, environmental conditions can be simulated.

4. Time Saving—Lead time can be reduced since the control for a new engine can be developed before the latter is completely off the drawing board. Design problems are pinpointed early and costly flight and engine time is eliminated.

A variable volume pump is used to deliver a corresponding speed for any voltage input received from the computer. For example, with a step input corresponding to a 3,000 rpm increase in engine speed, the pump supplies a fluid motor which attains proper speed in 0.2 seconds. This is considered very good performance for hydraulic equipment.

This simulated approach has largely eliminated the buga-boos—time and money—of more standard techniques. All it took was a little teamwork with electronic brains and hydraulic muscles. ▼▼▼



FUEL FLOW depends on fuel pump speed. An oil hydraulic transmission powers the fuel pump. Servo control of the transmission is shown in this block diagram.

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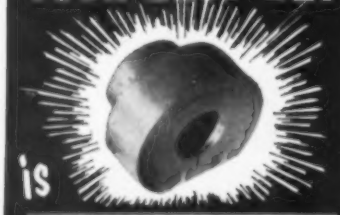

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Ideas from a Sales Engineer

Elmer F. Heiser

Elmer Heiser has been selling air and hydraulic components for 19 years. During this time he has solved many problems and admits to leaving some unsolved. He is the author of the book "Air and Oil Cylinders in Industrial Applications."

Valve Variations

MANY reasons can be cited why standard valves should be used wherever and whenever possible. Two of the most important are price and maintenance. Standard valves are made in quantities and the cost to the user is generally well below that of any special valve concocted for the purpose. Perhaps more important than initial price is the availability of repair or replacement units. A single valve can become a very critical part of not only a machine operation but also an entire production process. Failure with replacements not readily available may prove expensive as well as embarrassing.

Honest, We're for "Standards"

The first paragraph may sound like a useless introduction; almost like stating that it's usually better to buy foodstuffs from a store than to grow your own. It was written, though, to avoid misunderstanding. If this thing started right into a discussion of special valves that are not available, some readers would immediately assume that I champion the special instead of the standard. It's easy enough to get such a reputation without carelessly using the pages of a magazine to provide ammunition. The fact is that there are some (of narrow vision) who already believe that I spend more time trying to figure out how not to use ordinary valves than successful salesmen do selling them. By way of refutation, who enjoys servicing a trouble job when a mysterious special seems to be the heart of the system? Further, when you do figure out one of them, it is frequently easy to see where standard units could have been used to advantage.

So far the job of proving that a column on the original subject should not be written has been rather well done. Now we can proceed with an attempt to make a case for specially designed valves.

What justifies a special valve? Space limitations make a safe starting place. What can you do when a specific control arrangement is required but the space will not accept standard valves? We recently had an interesting problem where space was critical, and in addition a degree of safety was required. In trying to meet both requirements we tossed out conventional valves and combinations as fast as we cooked them up.

Now Let's Use a "Special"

Here, briefly, was the problem: A solenoid operated valve was to be mounted on a cylinder operated

buggy to provide quick acceleration and adjustable acceleration in both directions, plus accurate, adjustable stopping at or near each end of the stroke. In case of electrical failure the buggy was to stop. Our non-standard answer became a modification of a direct solenoid spring centered valve as shown in sketch Figure 1.

A. 3-position spring centered 4-way valve with a stem extending from each end.
B. Spring centered solenoid frame assembly with the two opposed solenoids mounted as indicated.
C. Cam roller on the solenoid frame assembly.

The centering springs of the solenoid assembly are heavier than the valve centering springs and

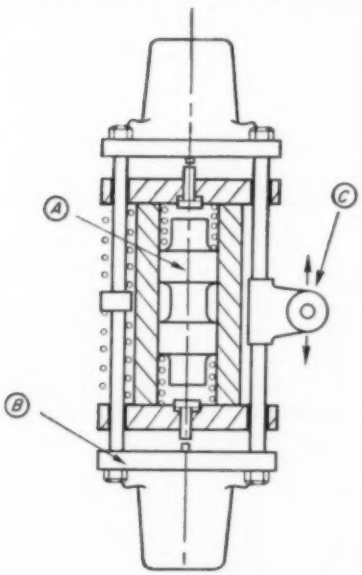
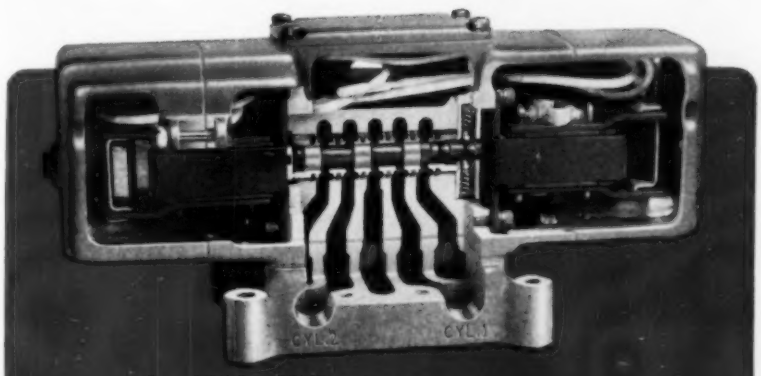


Figure 1

normally hold the solenoids in their usual operating position. When a solenoid is energized it fully shifts the 4-way to obtain full flow for quick starting. At an adjustable point near the end of the cylinder travel, a cam bar contacts the roller on the solenoid assembly and shifts the assembly "away" from the full open valve position toward the closed center neutral position. Thus while the solenoid is still held energized, the 4-way valve spool is shifted toward center to effect controlled deceleration.

The cam has a straight portion near the neutral position of the

something NEW!



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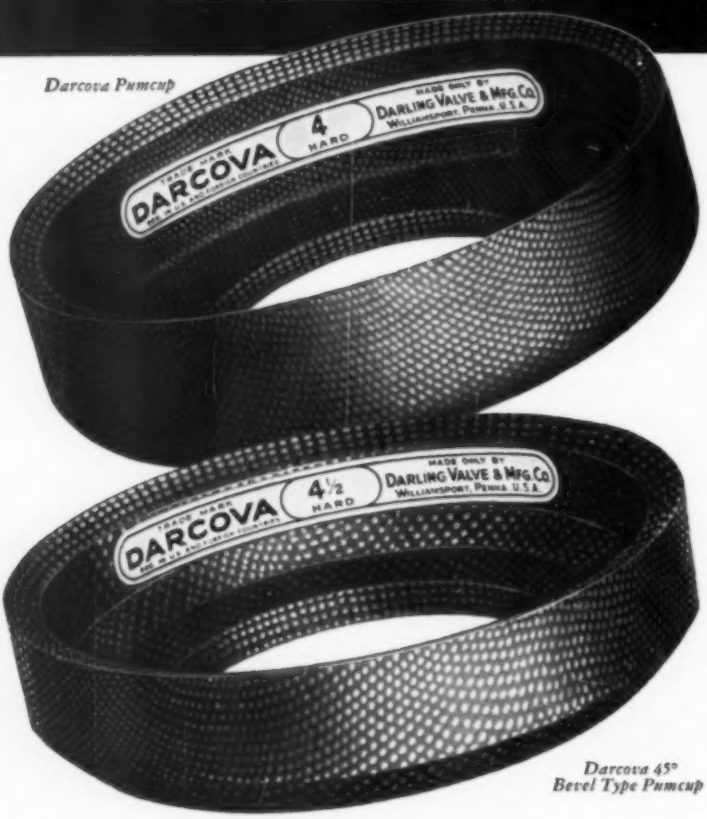

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DARCOVA THE ORIGINAL COMPOSITION CUP

TRADE MARK PUMCUPS

Ideas from A Sales Engineer

Continued

4-way valve so that after closing down from the rapid approach rate the cylinder continues at a very slow rate to the required stop position "X", where the solenoid is "dropped out". De-energizing the solenoid allows the valve to quickly shift to the closed or blocked center position.

The 4-way has feathering or throttling slots so arranged that a proper cam contour and length gives smooth deceleration and a suitable slow inching speed for an accurate final stop.

We Simplify a Circuit

Another special, justified by simplicity rather than space limitations, answered a problem where a series of small valves were to be panel mounted remotely from the

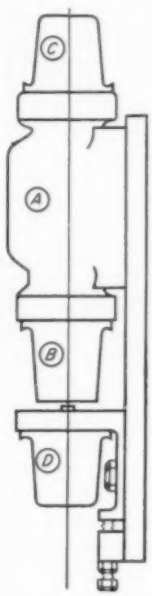

Figure 2

machine. Here each of the valves was to accurately position cylinders by adjustable steps along their stroke in one direction of cylinder travel.

We rigged up the non-standard contraption shown in sketch Figure 2. This does essentially the same thing as the valve in Figure 1, except it is positioned electrically and acceleration control is omitted. As shown it functions as

an intermediate position, throttling valve from one end only, but the same dual solenoid unit can be placed at both ends for two direction control.

Use of a Tandem Solenoid

The standard small direct acting solenoid valve "A" with its solenoids "B" and "C" has holes through the end caps over the solenoid plungers for manual checking. We used a special pin through these holes to obtain an intermediate "energized" valve position for an inching feed rate. Tandem solenoid "D" positions this secondary stop pin. For rapid cylinder travel solenoids "B" and "D" (on the same end of the valve) are energized. "B" shifts the valve spool completely while "D" follows along to an adjustable position.

At a point on the cylinder travel, just ahead of the required accurate stop position, a limit switch de-energizes "B", allowing the valve centering spring to shift the spool toward neutral. However "D" is still held energized acting as an "early" stop for the spring return of the spool. The cylinder now drops to a slow inching feed rate and stops with a reasonable accuracy when a second limit switch de-energizes solenoid "D". The cylinder operated mechanism is equipped with a long cam bar on which a series of dual cams are mounted. The two limit switches for dropping out "B" and "D" are fixed so all cam trips, which are adjustable, go through the same operation of first slowing the cylinder down and then stopping it at each required position.

This arrangement is a deviation from strictly standard valves. In fact, it omits some extra valves usually present in such a circuit. However, all components are standard and readily available with the exception of the adjustable bracket for the tandem solenoids. It saved considerable space, piping and valving and is basically very simple. Sufficient justification?

A Marine Circuit

Another problem where space was not a governing factor in making the decision, answered by spe-

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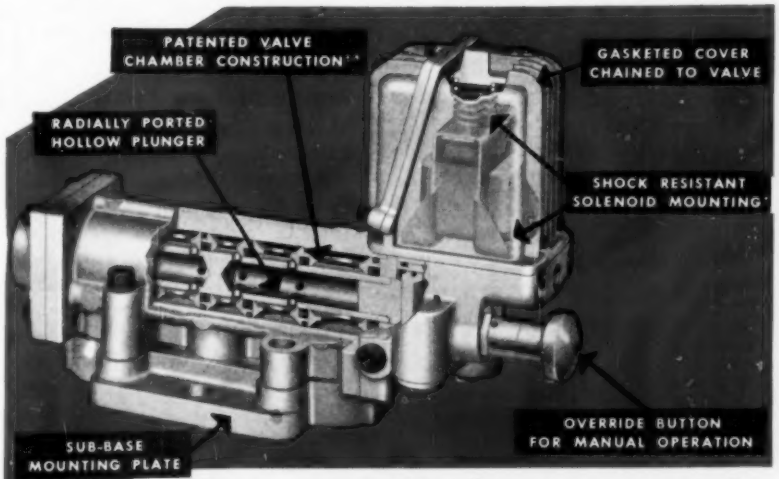
PATENTED VALVE CHAMBER CONSTRUCTION**
GASKETED COVER CHAINED TO VALVE
RADIALLY PORTED HOLLOW PLUNGER
SHOCK RESISTANT SOLENOID MOUNTING*
SUB-BASE MOUNTING PLATE
OVERRIDE BUTTON FOR MANUAL OPERATION

...offer many NEW advantages to make automation less costly and more dependable

Conservatively rated at 600 cycles per minute for continuous operation, these new, high speed valves feature:

1) **SHOCK RESISTANT SOLENOID MOUNTING*** available only in Quick-As-Wink design, reduces destructive hammering and vibration, assuring *greatly increased solenoid life.*
2) **VALVE CHAMBERS** formed by aluminum spacers held in accurate metal to metal end abutment** and sealed with "O" rings and "U" packers.
3) **HOLLOW, RADIALLY PORTED STAINLESS STEEL PLUNGER** directs the flow through the valve. No lapped joints.
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5) **OVERRIDE BUTTON** permits manual operation in case of power failure.
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*Patent Applied For **U. S. Patent No. 2,645,450

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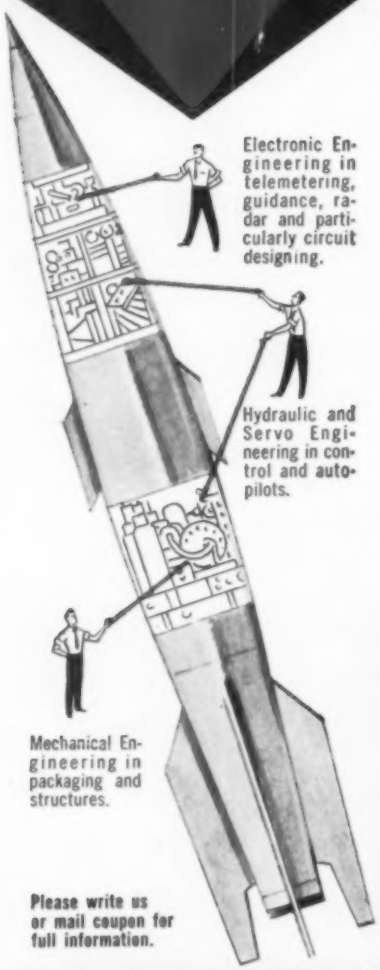

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IDEAS FROM A SALES ENGINEER

Continued

cial valving might be cited. The diagram Figure 3 shows a valving arrangement required for a special marine application where excessive vibration was a major problem and maintenance a secondary but an important problem.

Reduce Leakage Points

All valves and connections, with one exception, were to be 1¼ inch pipe size and the equipment had to be mounted under a low deck (on the ceiling in non-nautical language), with allowance for head room. The control includes eight separate valve elements and if made up of standard components would become quite an array consisting of more piping and fittings than valves, with many points of potential leakage. Also, it would be rather difficult to make an overhead assembly so that individual units could be conveniently removed for repairs without disturbing the remaining

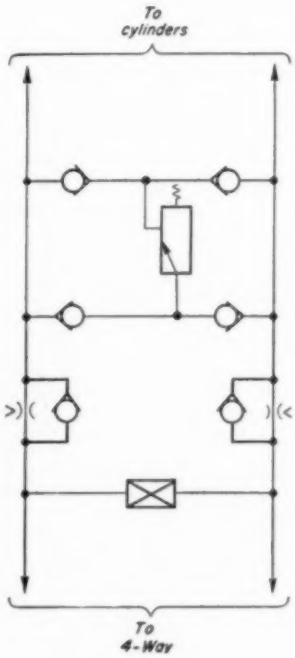
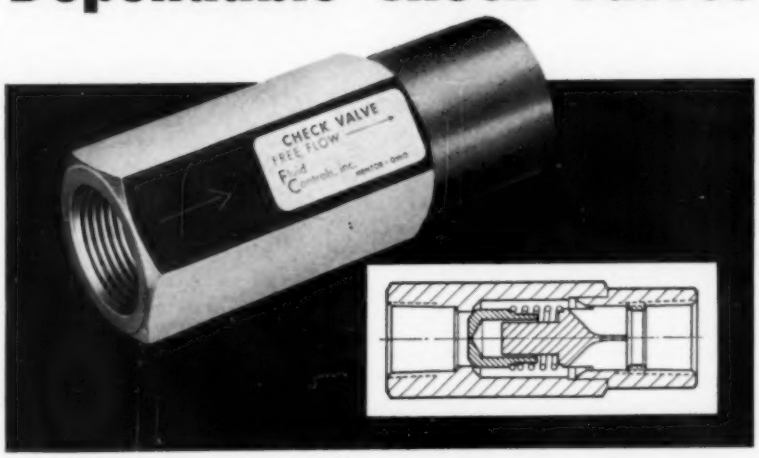


Figure 3

Dependable Check Valves



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- Pipe Sizes ¼" thru 1¼"

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birds nest. Combined with the fact that some thirty units were to be built, we felt that the vibration and maintenance problems justified some head scratching. As a result the assembly was boiled down into one mysterious 6" x 6" x 6" block, which will forever annoy any uniformed diagnosticians.

Matter of Judgement

Again, there are many places where standard equipment can almost do the job, and whether the time, cost and replacement limitations of special equipment are justified seems to be a matter of judgement. Let's see—the time required to scribble and sketch this column could have been used to write about thirty-nine letters and send thirty-nine catalogs to thirty-nine potential customers who undoubtedly have zero interest in special valves. See what I mean about judgment? ▼▼▼

EDITOR'S NOTE: *How about the reverse situation of what Elmer has described in this column? Have you taken a costly special design and revised the circuit to use standard components?*

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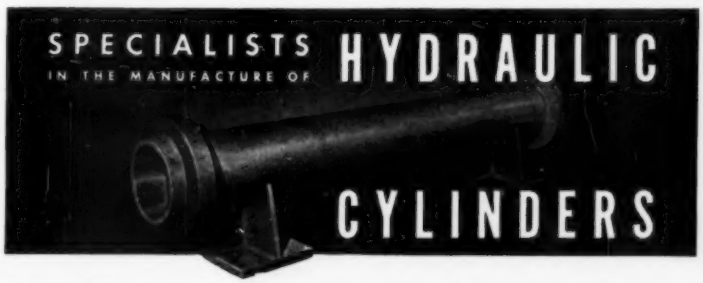
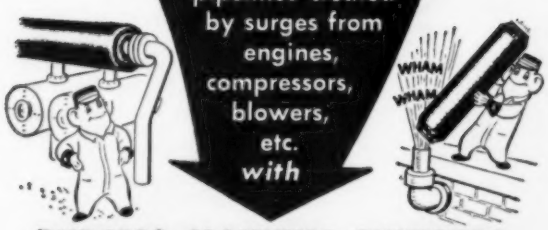


STOP

NOISE from air, steam and gases discharged to atmosphere

PULSATION in pipelines created by surges from engines, compressors, blowers, etc. *with*



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Circle 71 on Reader Service Card

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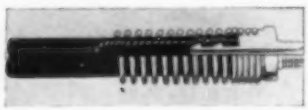
New Products continued

AIR HOSE
. . . features socketless fittings

Designation: No. 2550 Air Brake Hose
Features: Designed for use with tractor-trailer, axle brake chamber and tractor service line connections, this hose offers possibilities for use



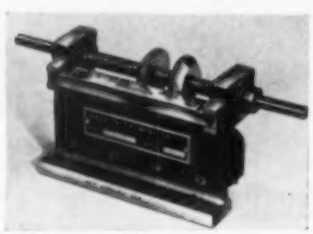
in other pneumatic applications. The socketless fittings are designed to mate with any standard connection and are available with male pipe or swivel and gladhand connections. Among the main advantages of the new hose assembly are lower initial costs due to the simplility of the one piece socketless fitting and ease of assembly. Fittings may be assembled merely by pushing the hose on the fitting. To reuse the fitting the hose is slit at the fitting and pulled off. Hose is designed to meet SAE and ICC specifications.

Aeroquip Corporation
Jackson, Mich.

Circle 166 on Reader Service Card

LIMIT SWITCH
. . . controls rotary motion

Designation: Model LS-1
Design: Exact limitation of rotary motion is assured by two cams driven along a rotating lead screw to actuate two precision snap-acting switches. The lead screw is connected to the system to be controlled by suitable gears.
Features: Rapid, precise adjustment to close operating tolerances



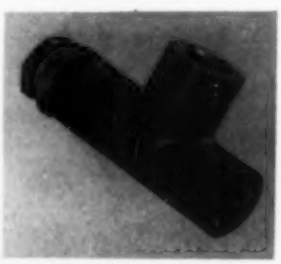
and excellent repeatability in high or low speed operation. Adjustability of 1 part in 3400 and repeatability of ± 5 degrees of a 360 degree revolution of the lead screw. Limit of travel for the cams is from 1 to 70 turns of the lead screw. Limits are quickly and accurately set by pulling the calibrated scale bar forward to disengage the teeth on the cams, rotating the cams on the lead screw to the desired limits, and allowing the bar to spring back to original position. Cam settings are read directly on the scale bar.
Specifications: Unit base measures 4⅛″ long x 2¾″ high and 1-11/16″ wide. The two ends of the ¼″ lead screw shaft extend 1-5/16″ beyond the base, making the total length 6¾ inches.

Arch Instrument Co., Inc.
North Quincy, Mass.

Circle 167 on Reader Service Card

RELIEF VALVE
. . . for thermal or main use

Designation: Models EA1160 and EA1164
Features: Both models can function either as thermal relief valves or as main relief valves. They have



been thoroughly tested and meet the specifications in Envelope AN 6245. Modifications of these valves permit their use in high temperature applications.
Specifications: Model EA1160 covers a range of 2300 to 3850 psi, with flows of 15 cc to 1.2 gpm. Model EA1164 has a range of 1000 to 2000 psi, with the same rated flow capacity as Model EA1160. Both models weigh 2½ ounces and are available for 7/16″-20 NF-3 threads or ¼″-18 NPT.

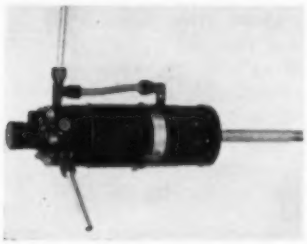
Electrol Incorporated
Kingston, N. Y.

Circle 168 on Reader Service Card

POWER POSITIONER
. . . leakproof air actuated

Designation: Power Positioner Model NN-2-2
Design: Unit is a quick operating pneumatic actuator for positioning valves, variable resistors, capacitors, transformers, etc. It operates on

force-balance principle with shaft motion being directly proportional to signal from remote controller. Supply pressure is applied through port in actuator cylinder to lower diaphragm. Pressure on upper side of the upper diaphragm is adjusted simultaneously. A positioning



spring located between the positioner input end and the control element supplies the feedback.

Features: Having no seals to wear or age, the unit is leakproof. Shaft opening in the positioner housing is not exposed to high pressure air and only a guide is required. Pressure level is the same for operation in either direction, eliminating need for a pressure regulator. Operation is rapid wtih high sensitivity and stability. Air consumption is low; installation is simple.

Specifications: Positioner is pilot operated at a maximum inlet pressure of 100 psig, with temperature from −65 degrees F to +150 degrees F. Positioning accuracy is 0.5 percent of stroke and time response for the full 2-inch stroke is two seconds. Models with longer or shorter strokes and in larger sizes can be provided.

Stratos Division Fairchild Engine & Airplane Corporation
Bay Shore, L. I., New York

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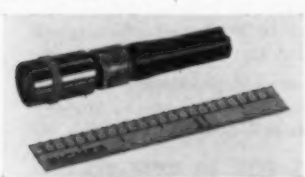
PRESSURE TRANSDUCERS . . . are sub-miniature size

Designation: Sub-Miniature SLM Pressure Transducer

Features: These transducers cover a range of applications for which precision pressure instrumentation



previously was not available. They exhibit characetristics superior to larger instruments with fast response time of one micro-second. Signals are exceptionally sharp and

Continued on next page

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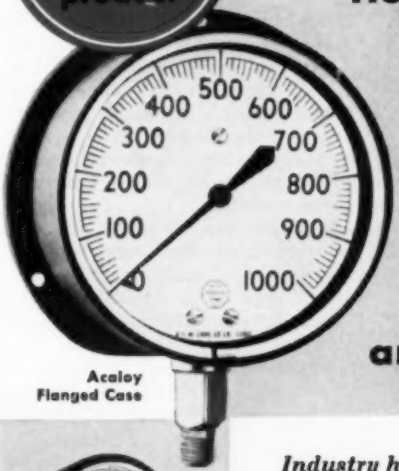

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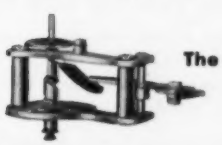

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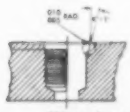

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free from electrical and mechanical noise. Successful measurements have been made as low as .01 psi on shock tubes. The instruments are calibrated by simple conventional static methods and will also measure steady and slowly varying pressures as well as very fast pressure transients.

Specifications: Available in four models: blast, shock-tube, ballistics and hyper-ballistics. Range of pressures from .01 to 100,000 psi. Subminiature dimensions are ¼-inch diameter by ½-inch long.

Kistler Instrument Company
North Tonowanda, N. Y.

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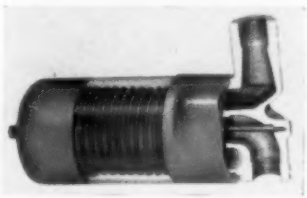
LINE STRAINER
. . . is self-cleaning

Design: Filter element is composed of "wafer" type filters, having convex metal tops and filter element bottoms. A stud extends up through a central passage, with the wafers assembled on the stud. The wafers are constructed to seat within each other and form the central passage.

Operation: Fluid flows down the sides of the element, over the solid metal tops of the wafers and then up through the filter elements. Filtering action is on the underside of the units. Momentum of the

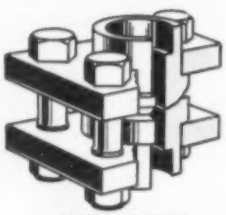


downward flow causes particles of contaminant to settle out for removal through a clean-out plug in the bottom.

Features: Entrance, filter clearance, center passageway and outlet are proportioned to provide optimum flow characteristics. Individual "wafer" units are inexpensive and may be replaced quickly. Elements have a self-cleaning action as contaminant tends to drop off when

SEALS WITH PIPE MISALIGNMENT

ALMAR FLANGE UNIONS



FLANGE UNIONS

UNION HOSE FITTINGS

FEATURE:

- SOCKET WELD CONNECTIONS
- TRUE BALL SEAT
- REVOLVABLE FLANGES
- HIGH OPERATING PRESSURES (To 3000 psi For Schedule 80 pipe)

CAN BE REASSEMBLED MANY TIMES RETAINING ORIGINAL SEALING QUALITIES

The Almar True Ball Seat assures leak-proof sealing regardless of considerable misalignment of pipe . . . revolvable flanges make assembly much easier. Special unions can be made to withstand pressures up to 10,000 psi.

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COMPLETE ENGINEERING SERVICE.

ALMAR HYDRAULIC VALVE COMPANY

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Distributing Line Of Cool Air From Receiver Tank
Vapor Free Air Near Point Of Use
Take Off From Top Of Pipe
Replaceable Desiccant

MURPHY TRIUMPH AA SEPARATOR-FILTER
Sizes: ¼, ⅜, ½, ¾; Weight 30 lbs; Pressures: 0 to 125 psi;
Price: $81.65 ea; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities.

Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

AFTERCOOLERS FOR 10 CFM TO 10,000 CFM—SEPARATORS—TRAPS

JAS. A. MURPHY & CO. INC.

Hamilton, Ohio

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the flow of liquid is interrupted. A minimum pressure drop is produced in the line. Diverging entrance passage reduces the momentum of the fluids as it changes direction to enter filtering area. This reduces pressure losses due to turbulence and distributes fluid evenly around filter element.

Specifications: Available in the following capacities: ¾"-5, ¾"-8, 1"-10, 1¼"-20 GPM. Filter element assemblies (without case) for sump applications up to 75 GPM.

Ripley Manufacturing Co.
Croswell, Michigan

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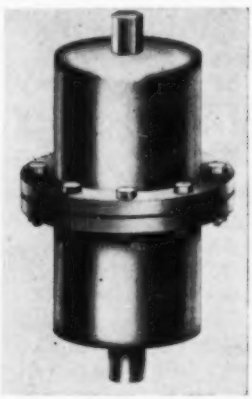
ACCUMULATOR
. . . features simple design

Features: Unit provides a positive barrier between two different fluids, yet is very easy to maintain. This is accomplished by the bolted flange construction. The simple design requires less parts and permits



the use of various metals to withstand most liquids. The only replacement part required is an inexpensive one-piece synthetic rubber seal. Response to shock is rapid as the rolling action of the seal is free from friction.

Specifications: Accumulators are available in 12 sizes from 30 to 2800 cubic inches for pressures up to 1500 psi. Standard units are made from steel, other materials may be specified.

Special Products Co.
Denver, Colorado

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AIRCRAFT HYDRAULIC MOTORS
. . . feature rapid acceleration

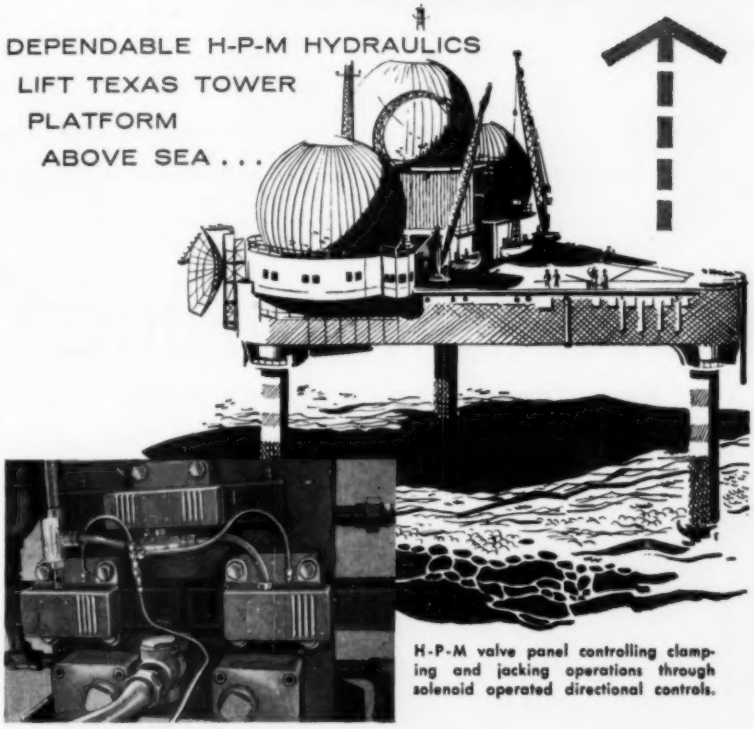
Designation: 54F Series

Design: Motors are constant displacement axial piston type for 3000 psi operation. They are 9-cylinder units with valve pistons

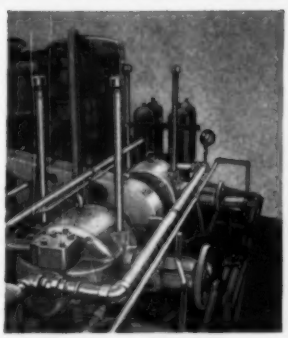
Continued on next page

ONE ISLAND . . .
COMING UP!

DEPENDABLE H-P-M HYDRAULICS LIFT TEXAS TOWER PLATFORM ABOVE SEA . . .



H-P-M valve panel controlling clamping and jacking operations through solenoid operated directional controls.



H-P-M double pump, double circuit, power unit with single diesel engine drive.

After the temporary legs of the Texas Tower have been lowered to the Atlantic's floor, the job of raising this immense "island" platform weighing approximately 10,000,000 pounds, above the ocean level, begins . . . and dependable H-P-M hydraulics were chosen for this important task. Up it goes—approximately 55 feet above the sea . . . slowly, carefully, on the three supporting columns. Each column is independently controlled, hydraulically, so that leveling is simplified regardless of the condition.

Not everyone faces this kind of engineering problem. Not everyone needs an immense power source such as this. But if DEPENDABILITY is your problem—rely on H-P-M hydraulics for the answer. Pumps, valves, cylinders for every heavy requirement.

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

HPM

NFPA

Circle 70 on Reader Service Card

New Products continued

placed in the same bore with the driving pistons and delivering approximately 180 degrees of power per cylinder revolution. The main hydraulic load in the motor is absorbed in tension in the shaft, eliminating thrust bearings and permitting a light weight housing. Use of timing pistons eliminates valving problems.

Features: Motors are also applicable to other hydraulic systems requiring high performance. May be stalled indefinitely without damage. In reversing service rotation is determined by direction of flow through the motor. Absence of mechanical linkages and a minimum of rotating parts produce low moment of inertia and extremely rapid acceleration. Motors may be installed in any position and will

start with 15 psi pressure drop and run with as little as 10 psi drop under no-load conditions. Where high ambient temperatures are encountered, a second case drain port may be utilized for separate cooling circulation.

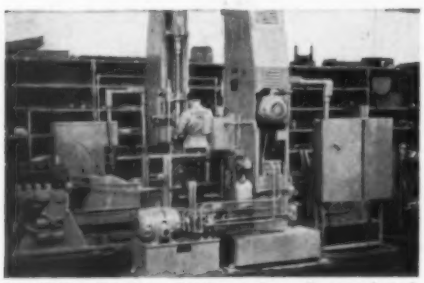
Specifications: Motors are available in eight sizes from 0.1 through 1.0 cubic inch displacement, for continuous, intermittent or continuously reversing duty cycles. On the 0.6 cu. in/rev. motor acceleration is 1.35×10^5 radians/second^2 at 3000 psi. Approximately .0003 second brings the motor to maximum speed. The 54F Series is fabricated to military specifications.

New York Air Brake Company
Watertown, N. Y.

Circle 173 on Reader Service Card

PROBLEM IN HYDRAULICS?

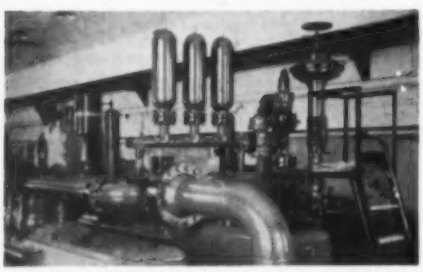
Case Histories Prove Greer Accumulator Most Versatile Hydraulic Component Ever Devised!



HONING MACHINE. Costly work spoilage reduced by Greer Accumulator absorbing shock each time honing spindles reverse direction.

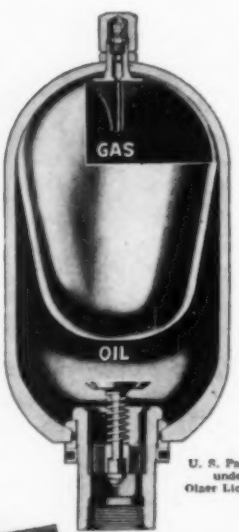
If your equipment is operated hydraulically, it is a proven fact that the Greer Accumulator can cut costs, improve performance, reduce size, weight and complexity of your machines.

If you are planning a new product or improving a present one, now is the time to let Greer engineers give you technical assistance and recommendations without obligation.



PIPELINE PUMP. Failure and damage to system eliminated when Greer Accumulators cut surges 53%. Works same way on valve closures.

HANDLING EQUIPMENT. Greater production through faster operation with fewer customer claims for damaged goods and spillage by Greer Accumulator eliminating harmful shock.



U. S. Patents under Olaer Licenses

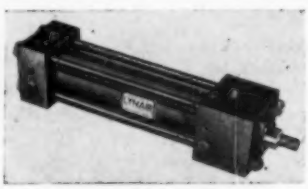
Write for Bulletin 301A for complete accumulator data & diagrams today.

GREER HYDRAULICS INC. • NEW YORK INTERNATIONAL AIRPORT • JAMAICA 30

SQUARE TYPE CYLINDER ... with minimum bypass

Designation: Square Type, Steel Head Hydraulic Cylinder.

Feaures: Cylinder is furnished with automotive type piston ring packing, backed up with O-rings to assure a minimum amount of bypass.



A large variety of rod sizes are available and all piston rods are high tensile TG&P shafting, hard chrome plated. Cylinders are equipped with metallic rod scraper. These new cylinders can be furnished with non-cushioned, non-adjustable cushions or adjustable cushions, on either end.

Lynair, Inc.
Jackson, Michigan

Circle 174 on Reader Service Card

Continued on page 134

Circle 14 on Reader Service Card

SOLENOID OPERATED AIR VALVES

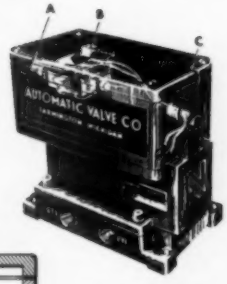
designed to

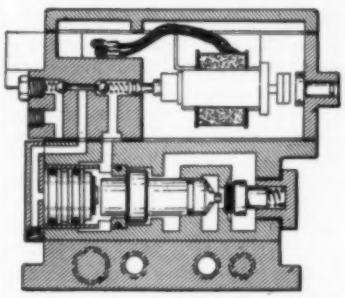
J.I.C.

standards

¼" - ⅜" - ½" - ¾"

4-Way—Model 441





FEATURES

A—Manual Operating Button

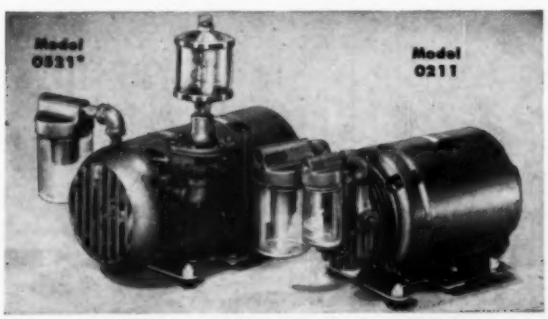
B—Water-tight and Dust-tight Solenoid Enclosure with built-in Electrical Junction Box.

C—Cover chained to Body

Write for Information—Prices

AUTOMATIC VALVE CO.

37419 Grand River Ave. • Farmington, Mich.



You get 10 big Integral-Motor-Pump advantages in these two NEW types (three models) of

GAST AIR PUMPS

Model 0211
1/6 hp, to 1.3 cfm, 25 psi or 27" vac.

Model 0321
1/4 hp, to 2.2 cfm, 25 psi or 28" vac.

Model 0521
1/3 hp, to 3.8 cfm, 20 psi or 28" vac.

*0321 similar in appearance.

1. Latest type G.E. "Form G" motors.
2. More compact than other pumps.
3. Total weight reduced 1/3—cuts shipping costs.
4. Motor mounting time and labor eliminated.
5. Simple, trouble-free rotary-vane design.
6. Vanes take up their own wear automatically.
7. Positive displacement, pulseless air delivery.
8. Improved appearance—smoother exterior.
9. Dependable for original equipment; plant use.
10. Forced air fan cooling on Models 0321 & 0521.

Write for new Bulletins V-356 and P-356! **Gast Manufacturing Corp.** P. O. Box 117-D, Benton Harbor, Michigan.

Original Equipment Manufacturers for Over 25 Years

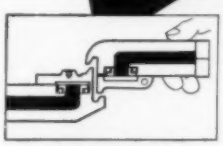
GAST • AIR MOTORS TO 4 H.P.
• COMPRESSORS TO 30 P.S.I.
ROTARY • VACUUM PUMPS TO 28 IN.
See Our Catalog in Sweet's Product Design File

Char-Lynn

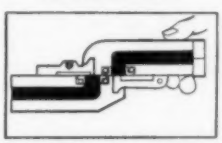
HYDRA-SEAL

HOSE COUPLER

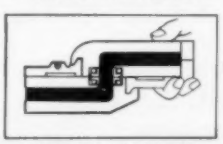
with NEW LAPPED STEEL SEALS



HOOK UP

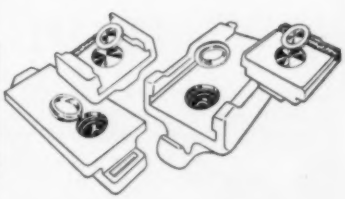


PUSH-CLICK!



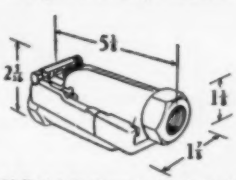
FREE FLOW

The Model H-730 Coupler now has identical HARDENED steel seals in each half. These interchangeable lapped steel seals are highly resistant to abrasion and nicking. Their durable quality assures a tighter, more positive, leak-proof, free-sliding seal . . . long-lasting, trouble-free.



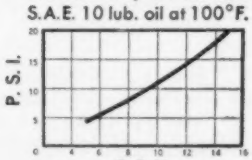
Designed and engineered as a quick-connect, self-sealing breakaway coupler for ALL fluid carrying hoses. Intended for service up to 2000 P.S.I.—will withstand surge pressure above 5000 P.S.I.

Unusual features are the high flow rating and relatively little pressure loss (see chart). Anodized aluminum die castings make this unit strong, corrosion resistant, light weight and dependable.



½" N.P.T. Female Both Ends

Pressure Drop vs. Oil Flow
S.A.E. 10 lub. oil at 100°F.



Free Catalog and Engineering Data on Request.

Char-Lynn COMPANY

Dept. AH-11 2843 26th Ave. South Minneapolis 6, Minnesota

Circle 53 on Reader Service Card

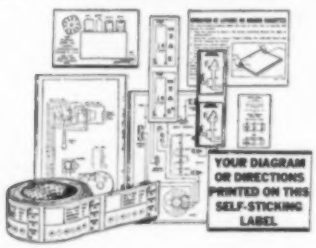
Circle 29 on Reader Service Card

New Products continued

WIRING DIAGRAMS, INSTRUCTIONS
. . . are quickly applied

Designation: Brady Self-Sticking Labels

Application: Scale drawings, schematics, instructions, tube layouts, etc. can be reproduced and mounted on zip-off liners or roll tape for low cost identification. Write-on



surface permits dating, stamping or initialing.

Specifications: Labels have a strong 20-ounce per square inch high-tack adhesive. Liner protects adhesive up to moment of application and removes quickly for fast, distortion free application. Samples on request.

W. H. Brady Company
Milwaukee, Wisconsin

Circle 175 on Reader Service Card

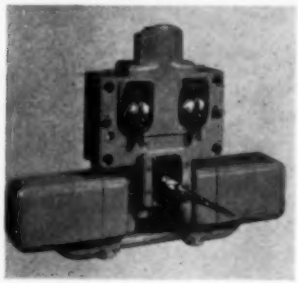
TRAVERSE AND FEED PANELS
. . . with new valve sections

Designation: Series CPP, CPD and CPN

Design: Panels are designed for use with ¾-inch nominal pipe size at maximum pressure of 1000 psi. Conventional or differential cylinder traverse action models are available. Being sub-plate mounted, these panels feature ease of installation and eliminate piping connections. Units are available with inverted designs and with open or closed center spools.

Features: Control valve section includes two locking type dials for selecting both fine and coarse feeds. This adjustment can be made during operation and is infinitely variable within specified ranges. Feeding sequence is handled automatically by position of the main spool without dead spots between phases.

Application: Series CPP models can be used to control fully automatic machining operations. An in-

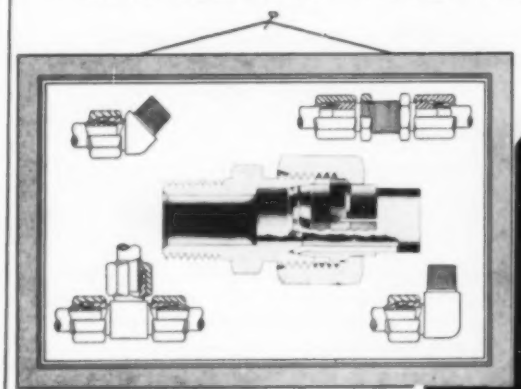


ternal check valve provides pilot pressure and a manual operating lever handles set-up or emergency operation. Series CPD models are combined with solenoids, and include a lever for manual operation. Both CPP and CPD models are for 115 volt, 60 cycle AC service, with 230 and 460 volt solenoids available. Series CPN panels have only a manual operating lever. They are designed for use with an external solenoid to actuate motion reversal. Broad selection of models is available.

Vickers Incorporated
Detroit, Michigan

Circle 176 on Reader Service Card

WE'RE IN THE PICTURE



FLODAR FITTINGS in every style, size and shape

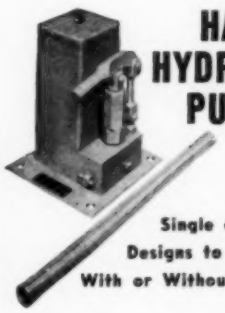
Here's a complete line of Flodar *Engineered Fittings* for assured performance. Self-flaring, No-Flare, Flare type and O-Ring Straight Thread—from ⅛ to 2" o.d.—to fit every installation picture. For dependable, leak-proof performance at high pressures, insist on Flodar Fittings.
Warehouse stocks in all principal cities.

Write for our New Catalogs

FLODAR CORPORATION
16911 St. Clair Avenue — Cleveland 10, Ohio

Circle 46 on Reader Service Card

HAND HYDRAULIC PUMPS



Single and Double
Designs to 20,000 PSI
With or Without Reservoir

160 Cubic Inch Reservoir with 8" x 8" Base Plate. Optional Size Piston: ⅜", ½", ¾", 1".

Handle length: 18 inches

Catalog No. 160

We specialize in hand pump units to operate in temperatures from minus 65F to plus 160F and with any capacity reservoirs required.

The single pump with ½" or ¾" piston now available in stainless steel.

WILLIAM S. PINE
Hydraulic Hand Pumps for 1001 Uses
1635 E. 22nd St., Los Angeles 11, Calif.

Circle 105 on Reader Service Card

SYNTHETIC LUBRICANT
. . . minimizes explosions

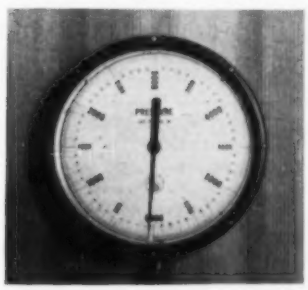
Designation: Pydraul AC
Features: Lubricant is designed for air compressors to minimize explosions and receiver fires as well as carbon deposits on exhaust valves and air system piping. It is a fire-resistant fluid equivalent in lubricity to premium grade lube oil. Conversion to Pydraul AC is simple. Splash-lubricated compressors need only be cleaned of petroleum deposits before installing the new fluid. Modification kits are available from major lubricator manufacturers for conversion of force-feed cylinder lubricators.

Monsanto Chemical Company
St. Louis, Missouri

Circle 177 on Reader Service Card

HEAVY DUTY GAUGES
. . . measure to 15,000 psi

Designation: Heavy-Duty Precision Pressure Gauges
Features: This line of test gauges combines ruggedness and precision. They were originally designed to



exacting specifications for calibration and testing of other instruments.
Specifications: Gauges are 12-inch, stem mounted and calibrated to a full 360 degrees. Models range in capacity from 150 to 15,000 psi.

Martin-Decker Corporation
Long Beach, Calif.

Circle 178 on Reader Service Card

WIPER-SCRAPER
. . . cleans reciprocating rods

Designation: Rod Wiper/Scraper
Design: Scraper ring is spirally wound from rectangularly-sectioned wire and precision honed for a light but positive fit. It is held within a molded annular elastomer element which distorts to form a seal between the ring and the housing recess and exerts an inward force upon the circumference of the scraper ring.

Continued on next page

BELMONT
BEL-VEE

The "Pressure-Sealing"
V-Ring Packing

SEATS AUTOMATICALLY
•
KEEPS EQUIPMENT RUNNING SMOOTHLY. CUTS MAINTENANCE
•
BASIC MATERIAL COMBINATIONS FOR VARIOUS SERVICES
•
A SIZE FOR EVERY ROD & STUFFING BOX

Scientifically designed to make the pressure seal itself, BEL-VEE Rings expand toward the rod and stuffing box wall, on the power stroke or with increased pressure, to automatically form the pressure seal.

On the return stroke, or with pressure relaxed, BEL-VEE Rings contract from the rod for free movement with minimum friction.

BEL-VEE Rings are individually molded in a number of basic material combinations. Offered in sets for pressures to 6000 psi. for sealing reciprocating rods of pumps, engines, compressors, hydraulic equipment and valve stems—handling water, oil, solvents, steam, air and gas.

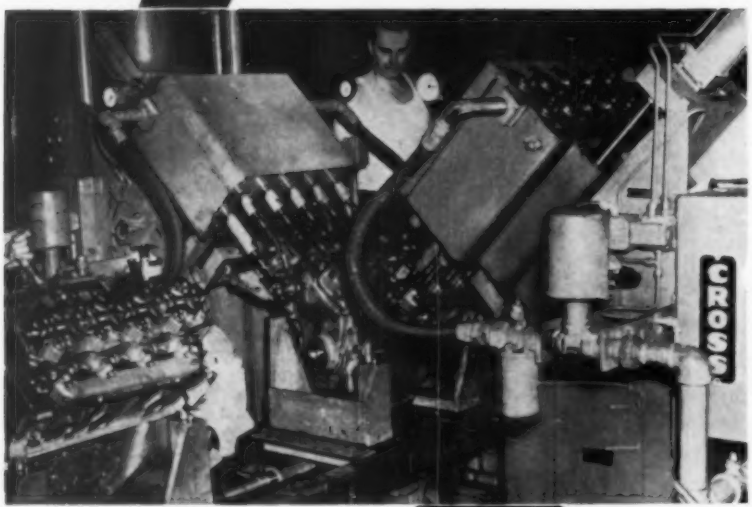
BEL-VEE Rings are made in practically every rod and stuffing box size. Ask the U.S.G.-Belmont Distributor nearest you or write for Belmont Bulletin No. 4R10.

THE BELMONT PACKING & RUBBER COMPANY
Butler & Sepviva Streets
Philadelphia 37, Pennsylvania

U.S. GASKET • BELMONT PACKING

Circle 138 on Reader Service Card

For Assembly Line
DEPENDABILITY



IT'S STRATOFLEX
HOSE and FITTINGS

Stratoflex Hose and Fittings were selected for this Thor 22-unit Multiple Nut Setter, engineered by the Cross Company and installed in the new Plymouth engine plant at Detroit. Stratoflex is specified in many similar hydraulic and pneumatic applications because of the flexibility, durability and small bend radii of Stratoflex Hose . . . and because Stratoflex Fittings assure leak-proof connections, are quick on-and-off, detachable and reusable. Available in a complete line of sizes and types for all industrial uses.

Order from your supply store or write for Bulletin S-2.

STRATOFLEX Inc.

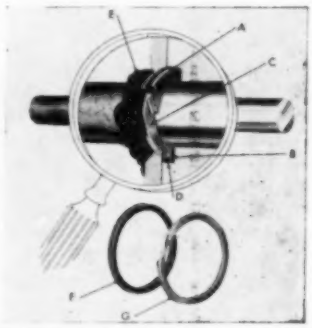
P. O. Box 10398 • Fort Worth, Texas

Branch Plants: Los Angeles and Toronto

Sales Offices:
Atlanta
Chicago, Dayton
Houston
Kansas City
Los Angeles
New York
San Francisco
Seattle, Toronto
Tulsa

New Products / continued

Features: Unit removes foreign matter and deposits from reciprocating rods resulting in savings in



maintenance, reduced wear and improvement in functioning. Spiral winding of the scraper ring eliminates any gap through which dirt might pass.

Specifications: Units are available in all popular sizes. The elastomer elements are of high grade buna compound and compatible with most mineral base oils and hydraulic fluids within temperature ranges of —40 to 250 degrees F. Special compounds are available for non-flammable hydraulic fluids and other applications.

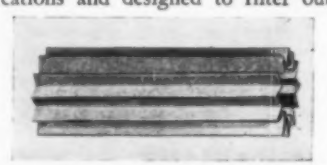
Equi-Flex Products Division
Master Pneumatic, Inc.
Detroit, Mich.

Circle 179 on Reader Service Card

POROUS BRONZE FILTERS . . . have large filtering area

Designation: Arrow Porous Metal Filter Elements

Features: Units are made of powdered bronze to blueprint specifications and designed to filter out



contaminants in hydraulic and pneumatic systems. These filters provide maximum filtering area within allowable overall dimensional tolerances, with added depth of filtration and controlled porosity. Elements are available in grades of particle size removal from 2 microns up to 151 microns.

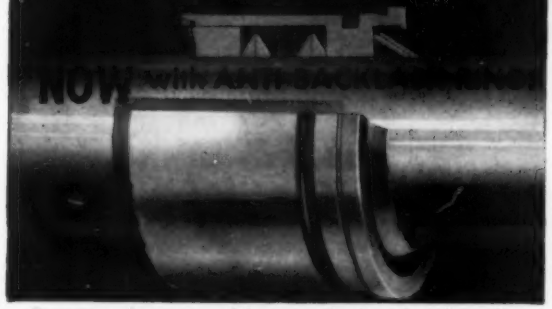
Arrow Sintered Products Company
Chicago, Ill.

Circle 180 on Reader Service Card

Continued on page 138

Circle 69 on Reader Service Card

THE ORIGINAL MONOPAK—CARTRIDGE



A complete packing unit for hydraulic or pneumatic rods or cylinders.

- Easily installed or replaced.
- Needs no adjusting.
- Reduces initial machining expense.
- Longer service life.
- Includes "Seal-Guard" rod wiper.
- Low friction coefficient.
- Shock and burst proof.
- Cuts machine down-time.

*Detailed literature on request.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

Circle 33 on Reader Service Card

CLOSURES

- Metal or Plastic Caps or Plugs to protect threads, tubes, machined parts, reamers, cutters, tools.
- Protect against thread damage, dust, dirt, and moisture.
- For inside and outside application. All sizes. Immediate delivery.

Clover closures are made in metal and tough plastic polyethylene. They are made in caps, plugs and special shapes to fit parts tightly, offering completely sealed protection during manufacture, shipping and storage. Backed by years of closure experience. Write for low prices and complete information.

Send coupon today!

METAL
Threaded caps for AN & SAE external threaded parts.

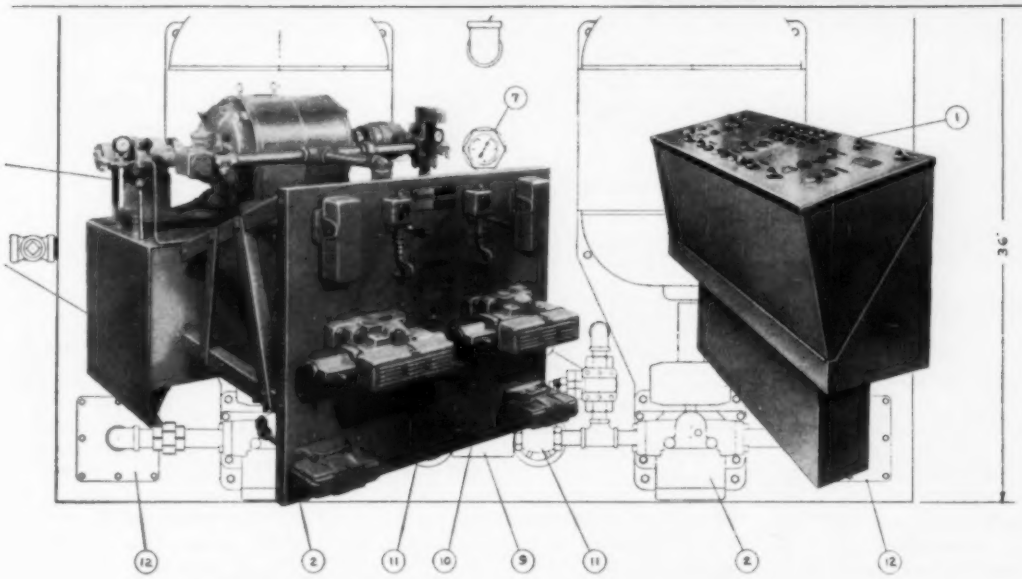
PLASTIC
Tapered parts for use either as a cap or plug.

METAL
Threaded plugs for AN or SAE internal threaded parts.

PLASTIC
(L.T. Series)
Non-threaded push-on caps for tubing, AN & SAE Fittings, reamers, etc.

Gentlemen:
Please send samples and prices of closures in
Polyethylene ☐ Aluminum ☐
Name.....
Address.....
City.....

CLOVER INDUSTRIES, INC. 578 Young Street Tonawanda, N. Y.



Producing 21 GPM @ 2000 PSI, 56 GPM @ 1000 PSI
25 HP Motor drives 3 pumps with selector and operating valves solenoid controlled. Special pressure switches. Operational control also shown.

APPLICATION
Fully automatic leaf tobacco packing press.

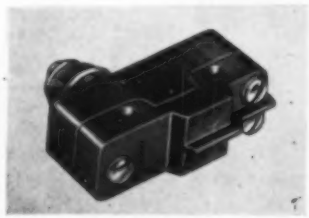
The CARDWELL MACHINE COMPANY
Franklin at 19th St., Richmond 11, Virginia • Phone 7-4593
Several attractive territories still open for qualified Hydraulic representatives.

REVISIONS	THE CARDWELL MACHINE CO. RICHMOND, VA.		
	CARDWELL CUSTOM HYDRAULIC POWER UNIT With Special Valve Panel and Electric Console		
	DATE 8-21-56	DWN. BY H.L.W.	9269-1
	CHK. BY C.L.H.	SCALE 3/8" = 1'-0"	

New Products continued

SPLIT-CONTACT SWITCH
. . . gives extra long life

Designation: Acro Precision Split-Contact Switch Model C-11008
Features: Switch has high capacity —up to ¾ hp, with dual circuitry through five terminals, and rolling spring snap-action. Normally a closed switch, the double-throw arrangement can control two single pole throw circuits, or can be used for double make or break in a single circuit. Rating of the switch is 15 amps. It is furnished with a pin plunger or any type of actuator to suit the application.
Performance: This new switch was actuated 40 million times without any signs of failure. It is versatile and can be expected to give extra long service life.



Acro Manufacturing Company
Columbus, Ohio

Circle 181 on Reader Service Card

LENZ "O-RING"

NO METAL TO METAL SEAL

J.I.C. APPROVED

HELD BY FRICTION GRIP OF THESE TWO

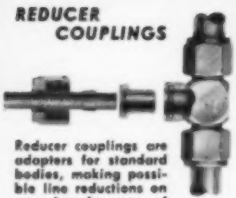
NO CONCENTRATION OF STRESSES DUE TO FLARES OR FERRULES FOR TUBE FAILURE

NO EXACT TUBE LENGTH NECESSARY

NOT NECESSARY TO CUT TUBE SQUARE

SEAL AND GRIP ARE SEPARATE

REDUCER COUPLINGS



Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

. . . A Hacksaw And A File Are All You Need

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. The higher the pressure the tighter the grip. Solve your hydraulic piping problems the easy way . . . with ease of assembly . . . no matching of exact tube lengths . . . simple leakproof connection for the life of the tube.

Reusable collet holds by friction grip up to bursting pressure of tubing.

LENZ FITTINGS MAKE THE JOB AS SIMPLE AS A B C

LENZ COMPANY

See our Catalog Page in Thomas Register 1956 Edition, Vol. 1, under classification "Fittings: Hydraulic" for complete list of types and sizes.

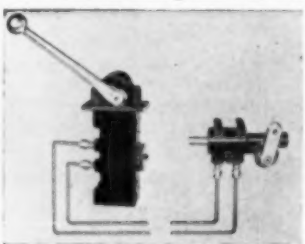
BOX 1044-A • DAYTON 1, OHIO

PHONE: ORegon 9364 • 3303 KLEPINGER ROAD

DISTRIBUTORS IN PRINCIPAL CITIES

REMOTE CONTROL
. . . is double-acting

Designation: Hydronic Remote Control Unit
Features: Two tubes connect the master-and-slave units, replacing rods, cables or push-pull controls. Unit is double-acting and can carry a full load in both directions. Control is fully temperature compensated and will stay in synchronization during wide temperature changes.



The Hydronic Company
Detroit, Michigan

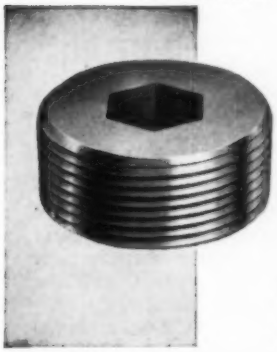
Circle 182 on Reader Service Card

PISTON SEAL
. . . for 300 psi service

Designation: Class 2 Flange Type
Features: Designed for high pressure service in pneumatic and hydraulic applications of instruments and actuators. Performing both bellows and constant area diaphragm functions, it can be applied to many types of equipment. Units work efficiently in assemblies not perfectly aligned or machined and expensively machined mating parts are not required. The flange of the seal is utilized as a gasket sealing the mating surfaces in cylinders of two-piece construction. Modern impregnated fabrics give the seals long life and resistance to fatigue and chemical action. The rolling action required no lubrication and

Continued on page 140

Circle 126 on Reader Service Card



specify standard UNBRAKO Dryseal-Thread Pressure Plugs

Use them in place of ordinary pipe plugs, or wherever liquids and gases must be contained under pressure. UNBRAKOS seal without compound. They are made of the same high strength alloy steels, have fully formed threads and the same internal wrenching feature as other UNBRAKO socket screws. Standard sizes—1/16" to 1¼"—are stocked by authorized industrial distributors. Ask your UNBRAKO supplier for Bulletin 883. Or write STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

Modernair

ECONOMAIR CYLINDERS

Tops in Quality, Economy, Compactness!

For Air or Hydraulic Service to 200 psi

- ★ Compact — feed ring head design eliminates bulky end castings!
- ★ Interchangeable mountings — flange, clevis, L-type
- ★ "O" ring seals throughout
- ★ Available in 1⅛", 2" and 3" bore sizes, any practical stroke length, cushion or non cushion types

Economair series cylinders offer today's best buy in quality cylinders at truly competitive prices — why pay more and get less? Write today for complete specifications, prices.

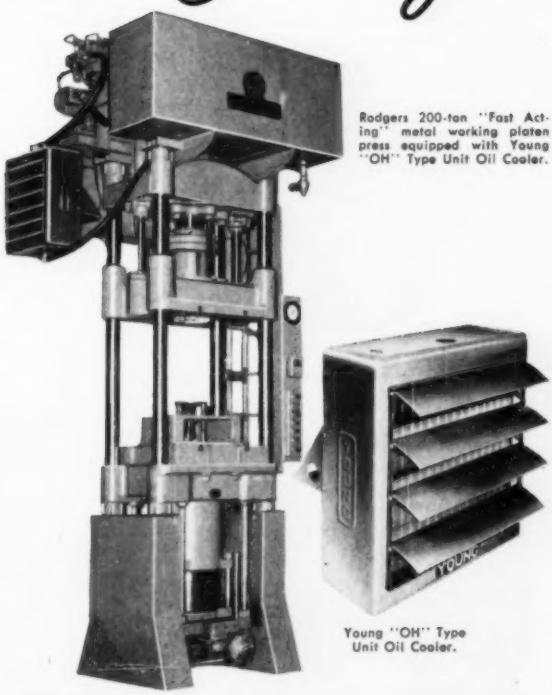
Modernair CORPORATION

Dept. B-11 400 PREDA ST., SAN LEANDRO, CALIF.
Member National Fluid Power Association

23

Circle 93 on Reader Service Card

200-ton platen presses depend on Young Cooling



Rodgers 200-ton "Fast Acting" metal working platen press equipped with Young "OH" Type Unit Oil Cooler.

Young "OH" Type Unit Oil Cooler.

Young Unit Oil Coolers cool hydraulic oil for metal forming and drawing presses

Rodgers Hydraulic, Inc., specifies Young "OH" Unit Oil Coolers for its 200-ton platen presses. The Young units cool the hydraulic oil and transform the waste heat into useable heat for space heating. Patented Turbulators break up hydraulic fluid flow, creating a wiping action which increases heat transfer efficiency 100%.

The metal working industry is only one of the many industries employing Young cooling equipment. Specify Young for your next heat transfer application.

Write Dept. 446-L for Free Catalog

Put Young Talent to work for you . . .

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.

Young RADIATOR COMPANY
RACINE, WISCONSIN
Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY
Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.
Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Circle 150 on Reader Service Card

New Products continued

is not affected by the finish or hardness of associated parts. Seal is free-positioning and has com-

plete relaxation within its designed stroke.

Specifications: Units are available in numerous sizes for 1 to 6-inch cylinder bore.

Bellofram Corporation
Burlington, Mass.

Circle 183 on Reader Service Card

SOLENOID PILOT VALVES
. . . for air and fluid service

Designation: Valvair Pilot Valves

Features: Valves are designed for control of remote pilot operated valves or direct control of small cylinders and similar devices. Solenoid enclosure is dust and moisture proof. Both plunger and spring, the only moving parts, are of stainless steel. Air passing around the plunger cleans and lubricates it and cools the coil.

Specifications: Capacities range up to 23.8 cfm air and 3.8 gpm hydraulic with control of 600 cycles per minute. Valves are available with or without integral junction box for 6-inch taped pigtail leads. Solenoid and junction box covers are fitted with captive fasteners to prevent loss. Removal of solenoid cover renders valve inoperative. Valves can be supplied for direct pipe connection, with sub-base, or drilled for mounting on manifold. Solenoid coils are supplied for 3 to 300 volts DC, 6 to 550 volts AC and 25 to 60 cycles.

Valvair Corporation
Akron, Ohio

Circle 184 on Reader Service Card

MAGNETIC SWITCH
. . . watches operations

Designation: Proximity Switch

Design: Detection is accomplished when object passes through a magnetic field set up directly in front of the switch's sensing end. A signal flows through the magnetic circuitry of the switch and operates a remotely located electrical control relay. There are no moving parts and no physical contact with the work piece is required.

Application: Unit locates objects containing iron on assembly lines,

in liquids and moving parts of automatic machine tools. Switches can program operations as the metal parts move to stations. Any break in sequence is detected.

Features: Switch is flashlight size

Champ® **HYDRAULIC HOSE ASSEMBLIES**
For longer, Trouble-Free Power Delivery

- **PREVENTS BLOW-OFFS**—Sleeve *locks* to collar of stem!
- **MAXIMUM HOLDING POWER**—Stem *and* sleeve serrated for positive grip and seal!
- **HIGH VOLUME FLOW**—Design provides greater flow efficiency!
- **LONGER LIFE**—A flexible and integral unit of unfailing reliability!

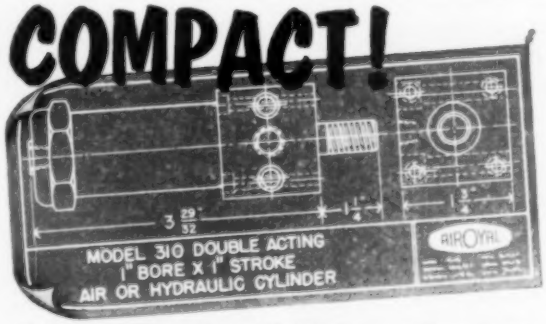
WRITE FOR CATALOG 8001 for details on Champ Hydraulic Hose Assemblies and Engineering Service to meet specific performance for ALL HYDRAULIC POWER DRIVEN EQUIPMENT.

Request to have a Champ Engineer discuss your hydraulic coupling application.

Champ® DIVISION OF HOSE ACCESSORIES COMPANY ® Reg. T. M.
LEHIGH AVE. AND 17th STREET • PHILADELPHIA 32, PA.

Circle 65 on Reader Service Card

COMPACT!



This is an AIROYAL Model 310 — 1" bore X 1" stroke double acting air or hydraulic cylinder. Note its small size. It's been designed into the smallest package possible without sacrificing its strength for severe duty applications. You'll find AIROYAL small bore (⅝", 1", 1½" and 2") cylinders just right for those jobs where space is restricted.

Other features you will appreciate are:

- **UNIVERSAL MOUNTING** — the cylinder can be mounted from either the two transverse holes or the four longitudinal holes;
- **EXTERNALLY HONED STAINLESS STEEL PISTON ROD** — resulting in extra long rod packing life;
- **LOW PRICE**—the cylinder shown above, for either 150 p.s.i. air or 750 p.s.i. oil, is only $27.00 list. $31.00 for pressures to 1500 p.s.i.

MANUFACTURED BY

THE AIROYAL CO
1990 SPRINGFIELD AVENUE
MAPLEWOOD, N. J.
REPRESENTATIVES IN PRINCIPAL CITIES

Circle 6 on Reader Service Card

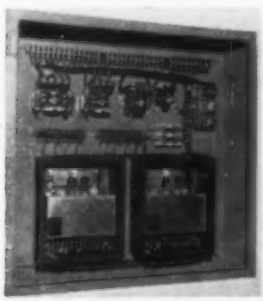
and sheathed in a heavy steel housing. The magnetic circuitry is embedded in a solid plastic solution. Sensing poles detect metal objects within ⅛-inch of its face, and switch cannot be set off by falling metal chips. It operates on 115 volt, 60-cycle current.

Minneapolis-Honeywell Regulator Company
Doelcam Division
Boston, Mass.

Circle 185 on Reader Service Card

CONTROL PANELS
. . . are custom designed

Features: Electrical control panels and systems are custom-designed with special attention to industrial requirements for special or hazardous locations and conform to JIC, NEMA or NMTBA specifications. Panels and systems are manufactured for all types of automatic machinery and processes and pretested



to perform control functions including automatic gauging and signalling to integrated sequencing systems for assembly machines. Controlled actions may be mechanical, chemical, pneumatic or hydraulic. Model illustrated coordinates press operations on an automatic production line, reducing seven manual operations to one automatic process.

U. S. Controls, Inc.
New York, N. Y.

Circle 186 on Reader Service Card

SILICONE RUBBER COMPOUNDS
. . . meet toughest specifications

Designation: Union Carbide K-1040R Series

Application: This new series of pre-conditioned vinyl silicone rubber compounds was developed to meet aeronautical specifications for high temperature applications. These compounds meet Aeronautical Materials Specifications, the joint military rubber, and American Society for Testing Materials specifications in appropriate hardness.

Features: They are described as being "pre-conditioned" because they are shipped in such a condition that they are very easy to process. The compound returns to a freshened state with a few turns of the mill. They also have controlled reactivity, making possible low compression set without use of toxic additives. This feature permits employment of new catalyst systems which eliminate step-wise post-cures for thick sections.

Specifications: The K-1040R series have a Durometer hardness from 40 to 80. K-1040R is the 40 hardness material and K-1048R the 80 hardness material. The R denotes the red color of the compound. This series have high tear, high elongation, over 800 psi tensile strength, low compression set, good oil resistance, low moisture absorption and good dry and wet dielectric properties.

Specifications: These compounds are marketed as Union Carbide K-1044R, K-1045R, K-1046R, K-1047R and K-1048R Silicone Rubber Compounds. They may be obtained uncatalyzed or with a catalyst specified by the fabricator, in 25, 50 and 150 pound fibre board drums.

Silicones Division
Union Carbide and Carbon Corporation
New York, N. Y.

Circle 187 on Reader Service Card

Continued on next page

TRADE MARK "FULFLO" REG U.S. PAT. OFF.

OIL-RELIEF BY-PASS VALVES

HOLDS OIL PRESSURES IN CONTROL ON STEAM AND HOT WATER GENERATORS

Just set the pressure—through 6 springs—from 0# to 500# and FULFLO VALVES hold it in a bulldog grip . . . no variation or adjustments. Pipe sizes: ¼" to 2"; standard or flange types.

It's highly important in this Cyclotherm Steam Generator built by U. S. Radiator Corp., Cyclotherm Div., Oswego, N. Y. And just as important built-in or attached to your hydraulic oil systems.

FULFLO VALVES ARE CHATTERLESS—because the cylindrical piston closes off the port in a shearing manner . . . **exclusive** with FULFLO.

FULFLO ENGINEERS can help you lick most oil-relief problems. Just write. No obligation.

Send today for

NEW MECHANICAL DATA BOOK. Colorfully illustrated with photos, graphs and data.

FULFLO

THE FULFLO SPECIALTIES CO. Inc.
PUMP AND VALVE MANUFACTURERS
BLANCHESTER, OHIO

Circle 48 on Reader Service Card

New Products continued

IN-LINE RELIEF VALVES
. . . for aircraft service

Designation: Vickers In-Line Relief Valves

Design: Valves are designed for use at 3000 psi, but have tolerances to permit application in circuits operating as high as 3700 psi. They are adjustable to deliver rated flow

over range of 2300 to 3850 psi. Units have direct-operated poppet construction. At low stress the valve spring produces a high spring force for reseating the poppet. All sliding parts are of hardened steel and only static O-ring seals are used. Hysteresis is negligible and a very small differential between cracking and reseat pressure can be maintained.

Specifications: Valves are obtainable in ¼, ⅜, ½ and ¾-inch tube size, and are built to meet latest military requirements. They may be obtained in high temperature design for operation within 550 to 650 degrees F.

Vickers Incorporated
Detroit, Michigan

Circle 188 on Reader Service Card

PRESSURE REGULATORS
. . . for precise air control

Features: Regulators are diaphragm-operated and designed for precision control of air pressure. Units respond instantly to sudden large volume demands without excessive momentary pressure drop. Wide variation of initial pressure has little effect on stability of reduced pressure setting.

Specifications: Numerous body connection combinations and relieving features are available. Units are also available in combinations of filter, regulator, lubricator for automatic filtration, regulation and lubrication of air operated devices.

Industrial Division
Watts Regulator Company
Lawrence, Mass.

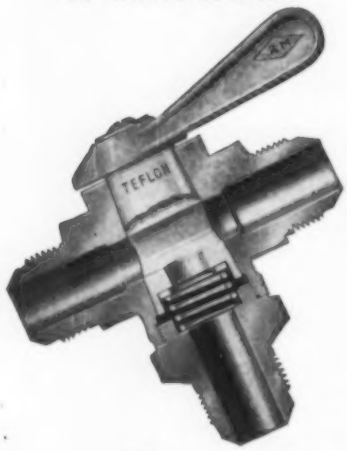
Circle 189 on Reader Service Card

NEW!

REPUBLIC
SELECTOR
VALVES

NEW!

"LO-TEMP"
−65° without lubricant



LO-TORQ SELECTOR
BALANCED PRESSURE
FOR EASY TURNING

With service pressure and seals on both sides of valving disk, turning is easy. Design is simple—maintenance is low. Many services—Air, and gas 4000 psi; fuel, hydraulic oil, petroleum, water, 6000 psi. Made in bronze, semi-steel, aluminum alloy, in three different portings, ⅛" to 1". Request Bulletin No. 454.

LO-TEMP SELECTOR

Teflon plug ends the need for lubricant. Easy turning—non seizing. −65° to 250°F. 2- 3- 4-way. 100 psi service. Made in aluminum alloy or stainless steel. ⅛" to 1" pipe or tube. Request Bulletin No. 754.

"LO-TORQ"
6000 psi service

145

RM

REPUBLIC MANUFACTURING CO.

13655 BROOKPARK ROAD • CLEVELAND 11, OHIO

Circle 148 on Reader Service Card

Circle 28 on Reader Service Card

CENTURY
RESERVOIR ACCESSORIES

BREATHER CAP (Model 8585)

- Contains replaceable dust & moisture proof air filter element
- Available with or without flange assembly
- Easy to install

Century carries a complete line of:

- STANDARD POWER UNITS—(SPECIALS TO ORDER)
- STANDARD RESERVOIRS
- RESERVOIR ACCESSORIES—

Oil-Level Sight Gage
Oil Clarifier Unit
Filler Breather Assembly
Breather Cap

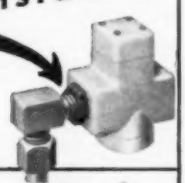
Engineers—Send for new catalog containing complete dimensional information on reservoirs, accessories, etc.

CENTURY HYDRAULICS, INC.
7703 LYNDON AVE. • DETROIT 38, MICHIGAN
Telephone: Diamond 1-3797

TRU-O-SEAL
TEFLON SEAL

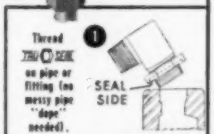
PAT. PENDING

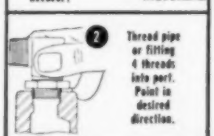
STOPS PIPE THREAD LEAKS instantly!

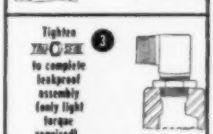


Prevents future leaks!

TRU-O-SEAL does away with messy pipe "dope" compounds, eliminates damage caused by overtightening of conventional leaky joints, and is immune to ALL known hydraulic fluids and to steam, air, water, solvents, and practically all gases and chemicals. It withstands temperatures from —100° F. to plus 500° F., saves cost and labor of special or welded fittings, and has been fully field tested and proven by leading manufacturers. Comes in ⅛" to 2½" pipe thread sizes.







Write for data and prices

TRU-O-SEAL DIVISION Flick-Reedy Corporation

2008 N. Hawthorne Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

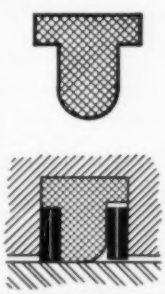
Circle 134 on Reader Service Card

A NEW FABRIC-REINFORCED MATERIAL FOR THESE BACKUP RINGS

MAKE THE GREAT PALMETTO G-T® RING GREATER!

PALMETTO G-T Rings are now available with remarkable "Sealsaver" backups—a development that does a *perfect* job of preventing the T-ring from extruding. These unique guards for the T-ring are cut from an exclusive fabric-reinforced sheet material developed and produced by Greene, Tweed. Even though they are relatively soft and flexible G-T Ring Sealsavers possess a tensile strength of 10,000 psi in *both* directions. They will not craze or fracture during installation *or* in service—enable the PALMETTO G-T Ring to withstand pressures higher than ever.

THE GIST OF THE G-T RING



CANNOT SPIRAL...

The Palmetto G-T Ring, unlike an "O"-Ring, will not twist and turn in the groove. The "T"-form prevents spiral failure in dynamic applications.

CANNOT EXTRUDE...

Resilient "T"-section supported by "Sealsaver" non-extrusion rings on either side makes extrusion impossible. As pressure is applied "Sealsaver" rings are urged against wall, blocking path of extrusion.

In designing for less costly, just as effective substitutes for Vee, Cup and Flange packings, many design engineers have discovered the many benefits PALMETTO G-T Rings offer. Now, with the "Sealsaver" innovation PALMETTO G-T Rings as a dynamic pressure seal for rod or piston applications cannot be matched for economy or effectiveness! Write for more particulars.

packing more performance into every application — PALMETTO Packings

GREENE, TWEED & CO. North Wales, Pa.

Circle 57 on Reader Service Card

Useful Literature continued

SHAFT COUPLING . . . which is an automatic centrifugal clutch is detailed in Bulletin 130 from Rawson Div., O. S. Walker Co. The coupling has two drum-shaped members, one attached to the driving shaft and the other to the driven shaft. Two sets of shoes are mounted between these drums. These shoes are actuated by centrifugal force to give smooth starting and overload protection. A table of ratings showing horsepower capacity for various sizes at various speeds from 390 to 3600 rpm for the standard couplings is included. A table of horsepower ratings for spring-control couplings at speeds from 580 to 1750 rpm is also included. Dimensional charts for the various types are given with illustrations of actual applications, and many other installations are shown.

Circle 218 on Reader Service Card

V-DRIVE CATALOG & ENGINEERING MANUAL . . . is offered by Maurey Manufacturing Corp. The 42-page booklet designated Form No. F-10 specifies V-pulleys, flexible couplings, V-belts and V link belts, and fans. The manual includes a section on engineering data covering such subjects as selecting the proper V-belt drive, determining small pulley size, and selecting a quarter-turn drive. A page of suggestions and terms gives installation and maintenance procedures. Proper belt tension, alignment methods, and replacement of worn belts and pulleys are discussed. Numerous selection tables are also included.

Circle 219 on Reader Service Card

PACKINGS . . . for every service are available from Belmont Packing & Rubber Co. Catalog No. 56 gives details and specifications on 246 types. Several recent packing developments are featured, including multi-purpose V-ring packings, criss-cross braid, twisted foil for oil and distillate temperatures to 1000 degrees F and wire-reinforced high pressure plastic packing. Distinctive mechanical principles of each type are explained and illustrated. Also included is a list of pointers for ·aining maximum service from packings and gaskets.

Circle 220 on Reader Service Card

HOSE SELECTOR . . . for rapid selection of hose according to ID, OD, minimum burst pressure, working pressure, and bend radius

is offered by Wiretex Hose Dept. Republic Rubber Div. The sliding selector contains latest SAE and industry specifications on hydraulic hose and is especially useful to designers and maintenance men.

Circle 221 on Reader Service Card

SYSTEM FILTERS . . . for central hydraulic systems using water are manufactured by R. P. Adams Company, Inc. Bulletin 909 should be of particular interest to steel, rubber and lumbering industries. In one application the units filter water recirculated by hydraulic debarkers. Filters are available in three sizes from 63 on 116 square feet of filter area. Three types of elements can be specified providing filtration down to 0.0005 inch. Specifications are given with an illustration of each type. Dimensional diagrams are included along with performance curves.

Circle 222 on Reader Service Card

TWO-WAY BALL VALVE . . . having a bolted bonnet and O-ring seal is outlined in Catalog No WV451 from Worcester Valve Co. The valve which is available in sizes from ¼ to 2 inches permits easy removal of the ball and seat rings by unbolting the bonnet. With the opening in the ball and seat rings maintaining the same smooth shape as the inside of the pipe, resistance to flow in the valve is below that of globe or gate valves, and friction loss is reduced to a minimum. Forged construction produces the advantages of lack of porosity, closely held tolerances, and absence of stress concentrations.

Circle 223 on Reader Service Card

AIRCRAFT PRESSURE GAUGES . . . produced by United States Division, American Machine and Metals, Inc. are covered in their 64-page catalog. There are two sections in this catalog. Section A, called Interchangeability Catalog, lists and describes the line of aircraft instruments available. This includes gauges for air, fuel, hydraulic and oil pressure. Section B is titled Gauges Carried In Stock and gives detailed information on available units. In Section A the information is given in tabular form. The models covered in Section B are treated individually and complete specifications are given with illustrations and diagrams.

Circle 224 on Reader Service Card

WELDING FITTINGS, FLANGES . . . manufactured by The Babcock & Wilcox Company's Tubular Products Division are described in a new 6-page folder. Various types and sizes of welding fittings and flanges are covered, including the full line of carbon, alloy and stainless steel seamless fittings and forged steel flanges. This folder is identified as FB-502.

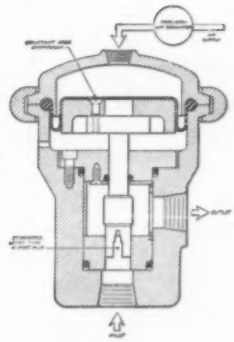
Circle 225 on Reader Service Card

ROTARY STEPPING SWITCHES . . . featuring positive stopping and shock-resistance is manufactured by Automatic Electric Sales Corporation. This type unit should be useful in air or hydraulic applications requiring positive positioning without danger of shocks interfering with sequences. Switches are indirectly driven and

Continued on page 146

Circle 74 on Reader Service Card

COMPLETE BACK PRESSURE CONTROL SYSTEM



This sectional drawing shows the design and construction of our novel Micro Delta P Controllers. When used with a regulated air supply, they provide a complete back pressure control system. A Micro Delta P Controller maintains a constant pressure on the discharge side of a non-pulsing hydraulic system by throttling the flow from the hydraulic power source at any flow rates within its range.

A significant feature of the Controller is the constant area, rolling type diaphragm. Use of it results in linearity between the loading pressure and the controlled back pressure. This construction, as opposed to piston type actuator, also provides greater sensitivity and repeatability with minimum hysteresis.

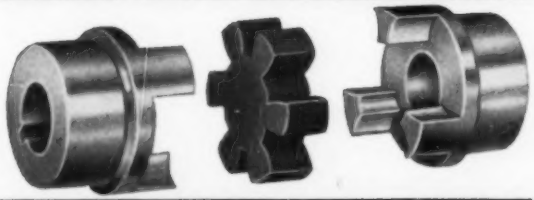
Micro Delta P Controllers have been used for many purposes such as the maintaining of a constant upstream pressure from the discharge of test pumps, and as controllers for hydraulic dynamometers. Two Micro Delta P Controllers used together can provide preset and intricate loading patterns for various types of actuator testing.

Write for our new bulletin, No. 544 which gives complete details and shows suggested schematic flow diagrams.

INDUSTRIAL ENGINEERING CORPORATION

525 E. Woodbine, Louisville 8, Ky.

A GERBING EXCLUSIVE!



FLEXIBLE COUPLING with Concave Jaw Surfaces...

The exclusive CONCAVE jaw surfaces of the Gerbing Flexible coupling actually holds the Buna-N rubber insert or spider within the jaws and prevents the rubber from extruding under load. Effectively absorbs shock, vibration, and misalignment. Requires no lubrication. Available for shafts ½" to 2⅛" and H.P. ranges from fractional thru 30. Deliveries from dealer and factory stocks. Increase your coupling service life. Write for complete information.

Concave jaws hold spider in position at all times . . . no extruding

Hub, bore, and outside diameter concentricity assure vibration-free operation.

Gerbing
MANUFACTURING CORP.
Northbrook, Ill. (Suburb of Chicago)
Dept. AH-611

Sensitive DIFFERENTIAL PRESSURE and VACUUM CONTROLS

J6K J27KB

By using UNITED ELECTRIC's Type J6K or Type J27KB control, it is possible to control accurately the difference in pressure between two pressure or vacuum sources. The J6K contains a single switch; the J27KB is a dual switch control.

System Differential	Up to 90 psi.
Switch Differential	J6K — can be set between limits of ½" Hg and 3 psi. J27KB — can be set between limits of 1" Hg and 5 psi.
Switch Ratings	15 amps. at 115 or 230 volts A.C. Also 20 amps. or D.C. switches on specification.
Switch Types	N.O., N.C., or Double Throw — no neutral position.
Adjustments	J6K — internally located, uncalibrated adjustment wheel. J27KB — each switch has independent, uncalibrated adjustment screw.
Electrical Connections	Made to screw terminals on switches through clearance hole in enclosure.
Pressure Connections	Two ¼" female NPT pressure connections.
Size	J6K — 7 5/32" x 4 27/32" x 2 5/16". J27KB — 7 1/16" x 6 1/8" x 2 7/8".
Approximate Weight	J6K — 2¼ lbs. J27KB — 2 lbs.

UNITED ELECTRIC ***manufactures a complete line of temperature, pressure and vacuum controls. Standard units can be modified or custom-built units made to your specifications. Additional information on pressure and vacuum controls is available upon request.***

UNITED ELECTRIC CONTROLS COMPANY
80 SCHOOL STREET, WATERTOWN, MASS.

Circle 54 on Reader Service Card

Circle 139 on Reader Service Card

Useful Literature continued

make steps when the coil is de-energized. Standard units use up to 3 cams and each cam can be divided into 36 intervals. Two models are available. Type 44 is a miniature model featuring small size and weighing only 14 ounces. Despite its size it accommodates up to six bank levels with 10 points plus home position. Type 45 has a self-contained rectifier and offers exceptional capacity of 12 or more bank levels with 25 points plus home position. Switches can be used for self-interrupted or impulse-controlled operation.

Circle 226 on Reader Service Card

ELECTRONIC TIMERS . . . manufactured by G. C. Wilson & Co. are described in an 8-page brochure. Current information and specifications are given for the standard line of delay, repeat cycle and interval timers.

Circle 227 on Reader Service Card

SHOCK MACHINE . . . Variable Duration model is a new addition to the line of environmental test chambers and equipment manufactured by Associated Testing Laboratories, Inc. Machine features all-welded construction and is designed to meet military specifications. Details, illustration and information are covered in their literature.

Circle 228 on Reader Service Card

THERMAL RELIEF VALVES . . . which relieve hydraulic systems of excess pressures built up by thermal expansion are presented in Bulletin No. 101-1 issued by Electrol Hydraulics. Three types are specified with dimensional and constructional data. These are the single type, dual type with two valves within a single aluminum housing, and the in-line type. Pressure ratings range from 1000 to 4100 psi, and minimum rated flow is 15 cc per min. Minimum re-seat pressure is 90% of cracking pressure and rated flow pressure is 110% of cracking pressure. The valves are designed for use with MIL-O-5606 or MIL-O-6083 fluids.

Circle 229 on Reader Service Card

TUBING SYSTEM DATA . . . Newly issued 8-page booklet contains information including charts and tables to aid in proper selection of tubing as to size, wall thickness and material for various operating conditions. Factors considered are flow requirements, pressures, severity of service and temperatures. Booklet is identified as Catalog File 4305 and is available from Parker Appliance Company's Tube & Hose Fittings Division.

Circle 230 on Reader Service Card

PNEUMATIC CONTROL SYSTEMS . . . manufactured by Westinghouse Air Brake Company's Industrial Products Division are described in Bulletin DO-00-1. Pneumatic control systems provide ease of operation and economies due to their versatility of function,

Continued on page 148

TRU-FLATE *Introduces their*

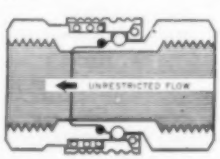
Straight Through Couplers

#ST17 coupler and #ST3F nipple illustrated

A complete new series of TRU-FLATE couplers designed to give greater flow with no line pressure drop.

Available in three basic body sizes with mating nipples—female taper pipe threads from ⅛" to 1"

Engineered by "TRU-FLATE", the high quality line of heavy duty "Valve Type" couplers and nipples for air, oil, water, gas, steam, freon, oxygen, etc.



Compare TRU-FLATE with other top quality lines for performance, durability, availability and price.

Write for literature and name of nearest distributor.

TRU-FLATE, INC.

● 888-92nd Avenue • OAKLAND 3, CALIF.

Circle 133 on Reader Service Card

top-notch DESIGN

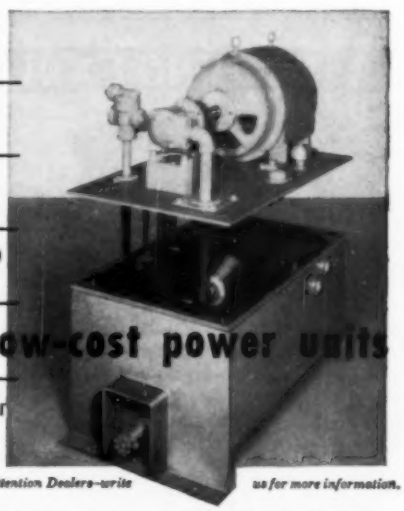
a complete LINE

all tanks IN STOCK

ALL WELDED construction

Now, Low-cost power units

write today for CATALOG



Attention Dealers—write us for more information.

Buy hydraulic power units as easily as you do any catalog item. Five standard sizes are available, with from ¾ to 20 hp. These PT-100 units are soundly engineered and built around stock tanks, insuring quick delivery. The TK-100 tanks are available alone (20 to 100 gallons), include all mounted accessories.

You can get specially engineered power units of any size and power through your Rosaen dealer.

The ROSAEN COMPANY

1756 EAST NINE MILE ROAD • HAZEL PARK, MICHIGAN

Circle 115 on Reader Service Card

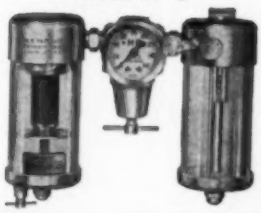
Circle 86 on Reader Service Card

3 in 1 GUARD of the AIR LINE

M-B

WHIRL-A-WAY
FILTER-REGULATOR
and
LUBRICATOR ASSEMBLY
MODEL W-3

the BEST PROTECTION TO YOUR AIR-VALVES, CYLINDERS, PNEUMATIC TOOLS, ETC.



The FILTER removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR capable of passing large volume with unrestricted flow and minimum pressure drop. LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

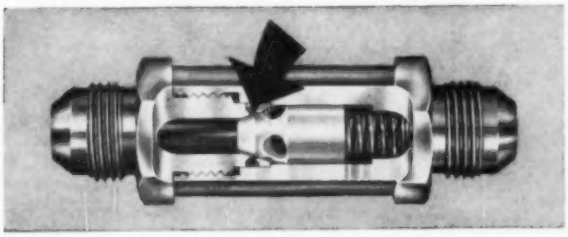
ANY OF THESE 3 DEVICES CAN BE USED AS SEPARATE UNITS OR IN ANY COMBINATION

WRITE FOR LITERATURE

M-B PRODUCTS
46 VICTOR AVE., Div. 10
DETROIT 3, MICHIGAN

Simple, Secure . . . Leak-Tight!

The FLEXIBLE SEAL SEAT*



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC
CHECK VALVES

* PATENT APPLIED FOR

Circle 78 on Reader Service Card

ELECTRO SNAP

ONE-WAY IMPULSE SWITCH

with exclusive advantages for automation

$10.50
plus $.25 shipping charge

Model ES4-KM2
½ actual size

ELIMINATES INTERLOCKING SWITCHES AND COMPLICATED ACTUATING DOGS

Ideal for pulsing solenoid valves on air-hydraulic controls, sequencing circuits, etc., because it allows other controls to reverse or operate the same circuit. Switch sends a short electrical impulse and then switches itself out of the circuit.

GIVES MORE DEPENDABLE CONTROL

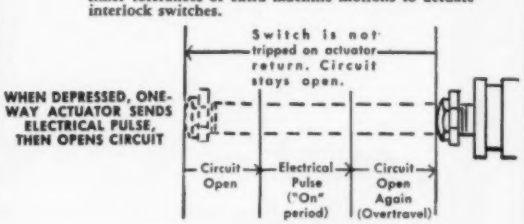
Switch replaces timers, relays, and troublesome one-way dogs to simplify circuits — cuts chances for failure. No delicate adjustments.

LOWERS COST OF CONTROL CIRCUITS

Impulse switch costs less than complicated control devices it replaces. Fewer switches are required for sequencing. Simple mounting.

SPEEDS UP AUTOMATIC OPERATION

Automatic machines can run faster because cycles can be more closely sequenced. There's no delay due to timer tolerances or extra machine motions to actuate interlock switches.


Switch is not tripped on actuator return. Circuit stays open.
WHEN DEPRESSED, ONE-WAY ACTUATOR SENDS ELECTRICAL PULSE, THEN OPENS CIRCUIT
Circuit Open
Electrical Pulse ("On" period)
Circuit Open Again (Overtravel)

SPECIFICATIONS

UL rated at 10 amps/125v AC Movement Dif. 0.020"
Operating Force 3½ lbs.

Model No.	Overtravel	"On" Period (inches of actuator travel)
ES4-KM1	3/8"	1/16"
ES4-KM2	5/16"	1/8"
ES4-KM3	1/4"	3/16"
ES4-KM6	1/16"	3/8"

TRY ON YOUR CONTROL JOB — ORDER NOW

Send Your Standard Purchase Order
Specify Model Wanted—Discounts on Quantity Purchases

ELECTRO SNAP
ELECTRO-SNAP SWITCH & MFG. COMPANY
4224 West Lake Street, Chicago 24, Illinois

Circle 45 on Reader Service Card

Useful Literature continued

initial low cost and space saving, and ease and economy of maintenance. Advantages of pneumatic controls and cylinders are illustrated and described in this 11-page bulletin. Several diagrams are given showing problems and solutions with pneumatic equipment. In the components section pressure control valves, positioning devices, double acting cylinders and air accessories are covered.

Circle 231 on Reader Service Card

SPECIAL ELECTRIC MOTORS . . . produced by Allis-Chalmers Manufacturing Company are described in three new bulletins. Specifications for open drip-proof motors, Types G, AP and APWW, are given in Bulletin 51B6210G. Ratings of 1/2 to 100 hp are available. Bulletin 51B7286G covers explosion-proof motors types GZZ and APZZ. Type GZZ is available in ratings of 1/2 to 30 hp and type APZZ in 1/2 to 100 hp. Totally-enclosed, fan-cooled motors, type GZ 1/2 to 30 hp, and type APZ 1/2 to 100 hp, are described in Bulletin 51B7225D. The bulletins include cutaways, tables of ratings and dimensions and a horsepower frame chart.

Circle 232 on Reader Service Card

VALVE SERVICE MANUAL . . . Service bulletin S1009 describing disassembly and assembly procedures for maintenance and overhaul of V13 valves with single or double acting operating plungers has been announced by the Kalamazoo Div., The New York Air Brake Co.

Circle 233 on Reader Service Card

BOURDON TUBE GAUGES . . . as produced by Heise Bourdon Tube Company, Inc. are covered in their 15-page booklet. Two recent developments in these units were the external bleeder and the integral movement. Complete description is given of these and other features with cross-section showing all details. The integral principle is carried out through the tube and linkage mounted on the same base casting. Units are protected against mechanical injury with a cast aluminum case mounted on lugs and isolated from all parts of the gauge mechanism. The booklet gives a brief and interesting history of Bourdon tube gauge development and covers the principles of this type of gauge.

Circle 234 on Reader Service Card

TUBE FITTINGS . . . for hydraulic pressures up to 20,000 psi and air pressures, under water, up to 500 psi are described in The Special Screw Products Company's Catalog K-954. The line offers a complete selection of stainless fittings in tube-to-tube and tube-to-pipe combinations and pipe unions utilizing the contained teflon principle. In this 15-page catalog the line is illustrated and described in detail. Technical data is given on the results of tests for

. . . count on GOSHEN

It makes no difference what service conditions, or what the system . . . if it's a dependable O-ring seal you need, just specify "Goshen". GRC O-rings are made of natural, synthetic and silicone rubbers, specially compounded to MIL, AMS, SAE, ASTM and industrial specifications. And, they're available in a complete range of AN, MS, SAE and JIC standard sizes, plus many non-standard sizes and special shapes.

FREE—This 12-page O-ring brochure is packed with useful information on sizes, groove dimensions and applications. Write today.

Goshen Rubber Co. INC.
CUSTOM DEVELOPMENT AND FABRICATION SINCE 1916
1311-6 S. TENTH ST. GOSHEN, IND.

corrosion resistance, teflon characteristics, pressure, vibration, temperature and torque. Stainless steel screwed unions are available for heavy duty applications featuring teflon ring reinforcement for the tapered metal sealing surface.

Circle 235 on Reader Service Card

AIR CYLINDERS . . . non-rotating type are illustrated and described in Catalog No. 110 issued by The S-P Manufacturing Corporation. Cylinders are designed to meet JIC standards in all respects. Features include floating cushions, brass tubes to prevent corrosion, removable bronze cartridges containing wiper and rod packing and

cold rolled steel end plates. Units are available in 21 models, ranging from 1-1/2 inch through 14 inch in bore sizes on prompt delivery. In its 12 pages the catalog gives complete engineering data on the company's line of standard air cylinders, valves and accessories.

Circle 236 on Reader Service Card

SUPER PRESSURE TUBING . . . designed for safe service at pressures up to 100,000 psi is described in Data Memorandum No. 22 published by Superior Tube Company. Manufacture of the tubing is described and a table is given of minimum bursting pressures. Another release, Data Memorandum No. 1, lists 121 metals and alloys used in producing standard and special small diameter tubing. The analyses are given in several groups for convenience and are identified as standard or special.

Circle 237 on Reader Service Card

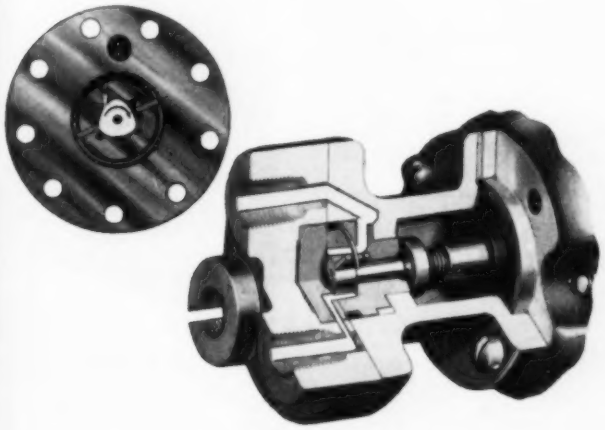
TIME DELAY UNIT . . . solenoid actuated and pneumatically timed is illustrated and described in Bulletin SR3 released by AGA Division, Elastic Stop Nut Corporation of America. The Agastat is a reliable and efficient instrument for introducing a time delay into

Continued on next page

WELDON

FLUID METERING PUMPS

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.

Compact • Light Weight

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

Circle 147 on Reader Service Card

The new **ROPER**
HYDRAULIC PUMP-MOTOR
for Improved **INDUSTRIAL SERVICE**

Designed by the same engineers who developed the famous Roper Rotary Pumps, the new Roper Hydraulic Pump-Motors operate on the same principle using two equal size, smooth-running gears in a precision-fitted case. These units offer low-speed and high-torque (much needed in the hydraulic field), and their versatility finds them well-suited to heavy-duty service within their operating range. They run equally well in either direction both as pumps or motors . . . they can be direct-connected without speed reducers, thus conserving space . . . they are easily installed, easy to operate, and are long on economy. Perhaps *you* have equipment that can be further improved with a Roper Hydraulic Pump-Motor. Send for all the facts today.

PERFORMANCE CHARACTERTISTICS

Available in foot and flange mounted models. Recommended speed range on larger sizes is from 200 to 800 RPM with pressures to 800 PSI In this range, Roper units require from 7 to 40 GPM flow and will develop up to 11.5 HP output at maximum speed and pressure. Smaller sizes may be operated up to 1200 RPM and up to 800 PSI which will require a flow of 16 GPM to develop up to 5 HP.

SEND FOR BULLETIN 22

ROPER
Rotary Pumps

GEO. D. ROPER CORPORATION • 711 Blackhawk Park Ave., Rockford, Ill.

Useful Literature / continued

circuits for pneumatic and hydraulic applications. It is readily adjustable, recycles instantaneously and extremely flexible in application. Constructed with few moving parts, the unit consists of a pneumatic timing head, a solenoid assembly, a switch and terminals. A special diaphragm and cap encases the head in which the air used for timing is recirculated, making the timing chamber dustproof. Switches are made for continuous AC duty and continuous or intermittent DC service. There are two basic types. Time delay starts in one type when the coil is energized, and in the other when the coil is de-energized. Typical application wiring diagrams are given in the bulletin with description and specifications on the two types.

Circle 238 on Reader Service Card

PORTABLE FILTER UNITS . . . for servicing industrial oils and solvents are described in a bulletin from Mayhew Products Company. Information and specifications are given for three portable models which handle from 3½ to 20 gpm.

Circle 239 on Reader Service Card

NEEDLE VALVE . . . with interchangeable stem plugs for universal service is manufactured by Hoke, Incorporated. Details and specifications are given in Bulletin 360 Series. Designated 360 Series Union Bonnet Globe Valve, the unit is designed for difficult and widely varying operating conditions from vacuum to high pressure, or distilled water to corrosive fluids. It is made of stainless steel bar stock. The non-rotating, replaceable stem plug is available with flat Teflon disc or stainless steel blunt point for long service life. Valve is for service up to 3000 psi and temperatures from —60-degrees to 450-degrees F.

Circle 240 on Reader Service Card

CLAMP COUPLINGS . . . for hydraulic hose assemblies up to 5000 psi working pressure are available from Eastman Manufacturing Company. New interlock clamp couplings provide positive positioning through accurate machining of the clamp and insert. Outside rib of clamp is locked between

the collar and hex of the insert before tightening. Accurate location of the clamp over the insert assures alternate mating of the barbs of the insert with the circular ribs of the clamp. The hose is uniformly compressed into each alternating recess increasing holding power and preventing pinching of the hose. Bulletin No. 40 gives specifications and description of the standard sizes of clamps and inserts available with diagrams showing the interlocking feature.

Circle 241 on Reader Service Card

PRESSURE REGULATORS . . . providing controlled output pressures practically independent of variations in flow and supply pressure are manufactured by Moore Products Co. Bulletin 4003 gives specifications, illustrations and a schematic drawing of Series 40 units. These regulators are pilot-operated and use the pneumatic "null" balance principle to hold set pressures constant. Units are actually self-contained pressure controllers since the main valve is operated by pneumatic functioning of a measuring nozzle. Graphs are provided in the bulletin giving the effect of flow changes on the regulated pressure for various models.

Circle 242 on Reader Service Card

CLUTCHES AND COUPINGS . . . for every purpose are manufactured by The Hilliard Corporation. A new series of bulletins gives detailed information and specifications on their line of single revolution, centrifugal, over-running, slip and friction clutches and couplings. Illustrations, cross-sections and charts give complete descriptions of the units.

Circle 243 on Reader Service Card

SAFETY VALVES . . . for air-operated equipment are manufactured by Acme Register Company. Units are made in seven sizes from 1/4 to 2-inches for pressures up to 3,000 psi. Valves function at any angle but horizontal positioning is recommended. Bulletin covers necessity for safety valves to prevent whipping air-lines and check wasting of air which puts an unnecessary drain on compressors. These valves feature a small bleeder port which forces water and grit from the lines before they are connected. Action of the ball is governed by the velocity of air passing through the hose. As a result air escaping through faulty equipment is quickly detected. Cross-sections are given showing the valve in operating and checking position.

Circle 244 on Reader Service Card

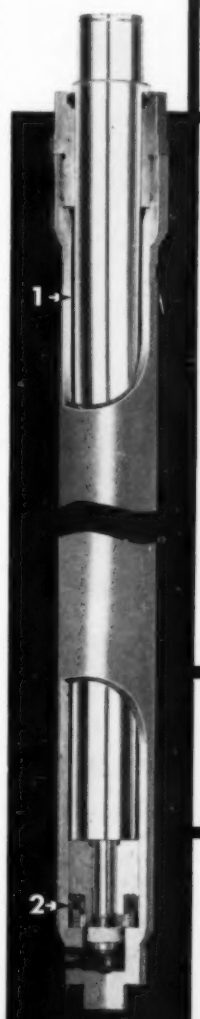
UNIONS AND FITTINGS . . . manufactured by Eastman Manufacuring Company for hydraulic hose assemblies are described in Bulletin 500, Section 5. A nomographic chart is included for rapid determination of proper hose size for flow in gallons per minute and velocity in feet per second. Specifications are given for the line of adapter unions for hose assemblies and reusable couplings and automotive tube fittings, hydraulic tube fittings, bulkhead O-ring adapters and miscellaneous adapter unions. Use of these straight and angled adapters and adapter unions permits positioning of hose before tightening, eliminating tortional strain. Units are machined out of steel or brass bar stock and forgings and steel parts are plated.

Circle 245 on Reader Service Card

Continued on next page

Good Design Deserves . . .

BHEW Custom-Built HYDRAULIC CYLINDERS



BHEW custom-built hydraulic cylinders give dependable operational performance wherever they are used. These efficient, close-tolerance cylinders require minimum mounting space; their cost is reasonable; there is no charge for tooling. BHEW builds cylinders to meet your specifications, delivers them on schedule.

BHEW CYLINDER FEATURES:

Standard and special designs available. • Double or single acting and telescopic. • 1½" to 8" bore. • Strokes up to 156". • Smallest possible O. D. and retracted O. A. length. • Oil cylinders with 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi. • Cup-type, ring-type or O-ring construction. • Choice of mounting.

1. **Honed steel cylinder.**
2. **Full double-sealing "U" cup packing.**

Furnished in a wide variety of mountings and anchor brackets.

Our engineers will be happy to work with you on any cylinder problems you may have. Without charge, of course.

Send us specifications of your requirements, for full information.

BHEW BENTON HARBOR ENGINEERING WORKS, INC.

622 LANGLEY AVENUE • ST. JOSEPH, MICHIGAN

Circle 19 on Reader Service Card

Useful Literature continued

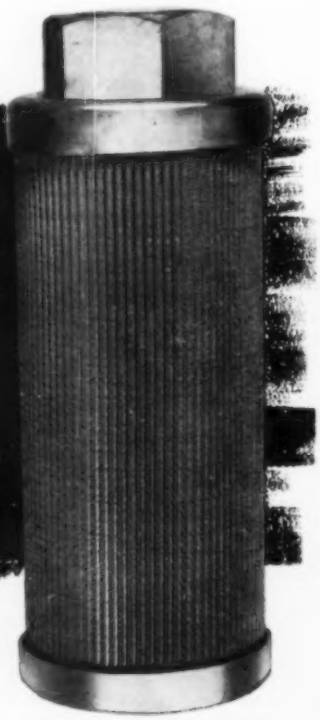
HYDRAULIC FAN DRIVE . . . for air-cooled heat exchangers and cooling towers is described in The De Laval Steam Turbine Company's new Bulletin 3009. Unit features unusual simplicity of design, having only three moving parts. Motors and worm gear speed reducers for the hydraulic fan drive are mounted and aligned on common bedplates with the pumps, pillow bearing assemblies and driven sheaves. Pump and motor parts are interchangeable and easily disassembled without disconnecting piping. Rotor housings, pump and motor parts and complete pumps and motors are carried in stock. Standard models operate at pressures up to 500 psi, brake horsepower up to 60 and can be direct connected to machines operating at 3600 rpm. Complete specifications are given in the bulletin with illustrations and a cutaway of the hydraulic motor.

Circle 246 on Reader Service Card

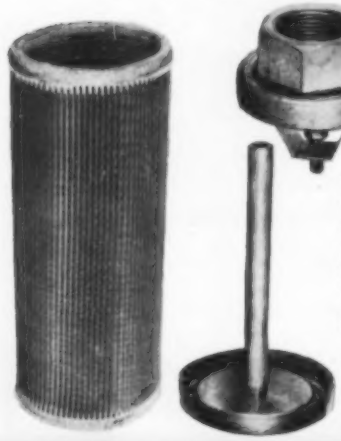
Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS



★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

Write for descriptive circular.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

HOSE AND COUPLINGS . . . for service up to 18,000 psi are described in Imperial Brass Manufacturing Company's Bulletin No. 30-30-B. Complete specifications are given for reusable couplings, cotton and rubber-covered single and double wire braid hose and fittings. The line offers a wide variety of end couplings and adapters to cover a wide range of applications eliminating large inventories of hose assemblies and couplings. Couplings offer additional economies with their reusable feature. They are designed to connect directly to standard 37-degree JIC and 45--degree SAE tube and pipe fittings, eliminating the need for adapters in many installations. Directions for assembling the various pictures showing the procedures.

Circle 247 on Reader Service Card

BELLOWS DESIGN GUIDE . . . contains valuable information on applications, design considerations and standards for metallic bellows. New 20-page Catalog No. 155 has just been released by Flexonics Corporation. This guide gives specific details on using bellows manufactured from various materials. Pictures, tables and charts implement the written data to adequately describe metallic bellows and their uses.

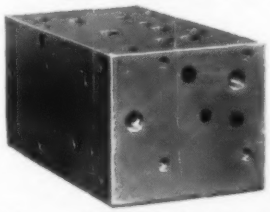
Circle 248 on Reader Service Card

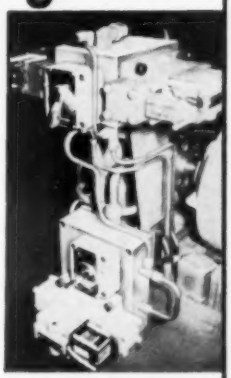
GAUGE PROTECTION . . . is provided with check and relief valves manufactured by Circle Seal Products Co., Inc. Complete protection is insured against overpressurization, unusual surges or mishandling of pressure circuits, with leak-proof sealing and accurate cracking characteristics of these valves. Loss of liquid or gas is avoided and personnel are not exposed to blasts. Further details and information available on request.

Circle 249 on Reader Service Card

Circle 20 on Reader Service Card

Your manifold problems Solved





We are Drilled Manifold Specialists! We can manufacture to your specifications . . . or design special manifolds to fit your needs.

Will accommodate from ⅛" to 1½" valves.

Drilled manifolds of solid ground steel offer such advantages as:

- LOWER COST
- COMPLETELY LEAK-FREE
- MORE COMPACT
- BETTER APPEARANCE
- EASY VALVE SERVICING

Send for FREE Booklet

Birmingham Hydraulic

DRILLED MANIFOLDS 14253 W. 11 Mile Rd.—Oak Park, Mich.

Announcing—

A NEW GRESEN VALVE With FLOAT Position

GRESEN HYDRAULICS

A Two Spool Directional Control W/Float For Parallel Application

FEATURES: Detent in Float Position—Self Centering From Power Positions—Fully Balanced—Relief Valve Has Replaceable Hardened Seat—Tripod Mounting Feet—Smooth Positive Throttling Action —Hardened and Chrome Plated Spools.

SPECIFICATIONS: Capacity 20 GPM (at 20 Ft/seconds)—Maximum Pressure 1500 PSI—Parallel Application—Shipping Weight 22-1/2 Lbs.

Write for literature

GRESEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. H-106 Minneapolis 11, Minn.

...For the first time:

Positively Leakproof HYDRAULIC PACKING

Linear VEE-DAM® rings

Here's the revolutionary, split-V-Ring design that makes other hydraulic packing obsolete! Linear VEE-DAM Rings assure absolutely leakproof performance—even without precise fitting.

★ **Sturdy rubber dams** (A) hermetically seal off center groove sections when rings are stacked together . . . eliminate labyrinth flow. **External abutments** (B) provide stabilizing support and prevent lateral leakage. Even when gaps occur at ring joints, fluid can't leak past VEE-DAM Rings.

★ Save on installation and maintenance . . . reduce down time, with Linear VEE-DAM Rings—a real achievement in hydraulic packing design! They're available in a variety of compounds to meet extremes of pressure and temperature. Get the facts now.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

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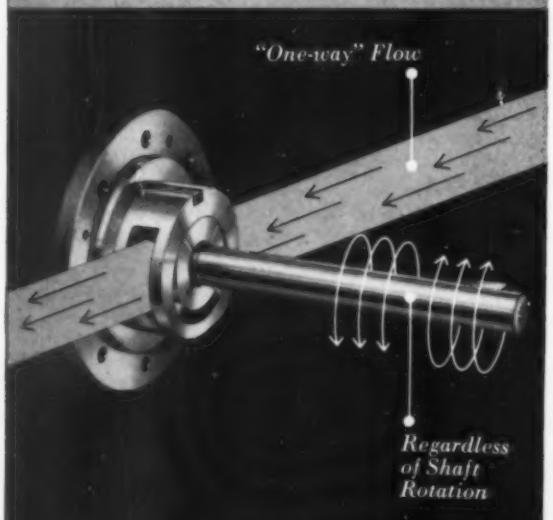
COMPACT PUMPS

FOR "BUILT-IN" USE



. . . Brown & Sharpe Automatic-Reversing Vane Pumps

Here are the compact, convenient lubricating pumps for integral-mounting on machines or mechanisms that reverse. Brown & Sharpe Automatic-Reversing Vane Pumps continuously, automatically, discharge lubricant in one direction—regardless of shaft rotation. Direction of discharge can be easily changed in the field. Brown & Sharpe Automatic-Reversing Vane Pumps are available in the following models: 1. *Stripped Pump without housing.* Offers minimum projection from machine surface . . . for use when suction and discharge ports can be designed into machine. 2. *Stripped Pump with housing.* For use when ports cannot be designed into machine; or when outside piping is desirable. 3. *Complete Pump.* Three pump sizes cover most requirements: 2½ gpm, 5 gpm, and 11½ gpm, at 0 lbs. pressure and at 1140 rpm. For complete design and operating details, write for Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

Buy Through Your Local Distributor

Brown & Sharpe

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Circle 120 on Reader Service Card

Now! BAR STOCK BRASS HOSE FITTINGS *That Give You Maximum Flow of Air and Water*

Service Mfg. & Supply Co. J.I.C. union type fittings are available with 37° flare adapters—elbows are 45°, 90°, in standard and long lengths. All fittings are wide aperture and machined from top quality bar stock. This gives you non-porous and maximum flow fittings.

Special Design—Designing and manufacturing special fittings to your prints is our specialty. In addition, our complete stock of non-porous wide aperture standard fittings will serve your normal needs.

Short-Runs—Designing and manufacturing short-run orders is also a specialty of Service Mfg. & Supply Co. Fittings range from any length elbows to special "Y" fittings. Write today for catalog.

J.I.C. Union type

Solid type

"Y" fittings—Standard stock or designed from your prints.

Jobber and agent inquiries invited.

Service Mfg. & Supply Co.

315 East State Fair Detroit, 3, Mich. TWinbrook 3-6565

THERE IS NO SUBSTITUTE FOR LONG-LASTING . . . .

● Only *Plastic Lead Seal assures you a seal that will last as long as the connection itself. It is ideal for water, oil, gas, steam, refrigerants, chemicals and petroleum products at temperatures as high as 500°F., pressures to 6000 psi.

Because PLS remains plastic at all times, it gives permament assurance against leakers—regardless of vibration, expansion or contraction—yet permits easy disassembly of connections, even after years of service.

It's economical to use PLS on pipe joints, plugs, screwed fittings, flanges and gaskets—because it takes less to make a perfect seal.

PLS is easy to apply . . . and it's easy to try! Just send for a free sample.

Available in 1-lb. cans (brush top or friction), 4-oz. plastic tubes, 5-lb. cans, 15 and 28-lb. pails and 85-lb. drums.

6405 Oakton Street, Morton Grove, Illinois, (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*

CRANE PACKING COMPANY

Circle 36 on Reader Service Card

Useful Literature / continued

CONSTANT DELIVERY PUMPS . . . for pressures up to 3000 psi are described in Bulletin 4600 released by The Oilgear Company. Construction, operation, speeds, capacity and pressure ratings are given for 21 different sizes of constant displacement radial piston pumps from 4 to 150 hp. These units feature custom-built reservoir paks. Standard small reservoirs or large motor base reservoirs are available. These pumps can be used individually on small and medium presses, calender hold-down systems, and with variable displacement motors to provide variable speed constant power drives. Illustrations in the bulletin show pumps connected to double-end electric motors, in a 3-motor installation, in a valve distributing block operating leveling cylinders on large shovels and other applications.

Circle 250 on Reader Service Card

AIR CYLINDERS . . . with valve-in-head feature are described in literature of the A. K. Allen Co. Information and specifications are given on five type "A" models with the 4-way built-in valves. Models are single and double solenoid, air pilot-spring return, double air pilot and hand operated. Cross-sections are illustrated with replacement part numbers.

Circle 251 on Reader Service Card

FLOW METER . . . designed for precise flow measurement and evaluation of aircraft and automotive components is described in Fischer & Porter's Catalog 10-A-34. Offering high accuracy, wide range and low pressure drop Figure 164 Multi-Stage Flowrator Meter is available for laboratory use. Designed to meet military specifications, the unit has the latest developments in hydraulic and construction features, including self-contained piping, vents and valves. One to six stages may be installed and flow measurements are possible from 5 to 100,000 pounds per hour with low pressure loss and accuracy of 1/2 of 1 percent of flow rate. Included in the bulletin are sizing chart for the different floats, a chart of meter dimensions and a chart showing types of piping arrangements and dimensions.

Circle 252 on Reader Service Card

R/M VEE-FLEX®

is America's most copied packing...

BECAUSE **it is designed for practically every piston and rod**

BECAUSE **it can be supplied with rock-hard adaptor rings**

BECAUSE **it has polymer-saturated fabric**

BECAUSE **it has precision trimming**

BECAUSE **it has proper interference for automatic sealing**

No matter what your hydraulic application, you will get better sealing with R M Vee-Flex. The background of this packing is top-flight design engineering combined with superior molding techniques. The result is a self-sealing, self-adjusting packing that will always give you a perfect seal—even at pressures in excess of 6000 psi.

R/M MAKES A COMPLETE LINE OF MECHANICAL PACKINGS

R/M's line of molded hydraulic and pneumatic packings includes:

VEE-FLEX PACKINGS
VEE-SQUARE PACKINGS
HOMOGENEOUS VEE-RINGS
FABRIC PISTON CUPS

For complete information, send for booklet

R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; Passaic, N.J.; Neenah, Wis.; No. Charleston, S.C.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Laundry Pads and Covers • Bowling Balls

Circle 110 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Richard R. Kesti
Valvair Corp.

Fred M. Mahan
Ross Heat Exchanger Division

Richard P. Hempel
Dollinger Corporation

Richard R. Kesti has been appointed chief engineer for **Valvair Corporation** and Sinclair-Collins Valve Company, and will head the general engineering divisions of both companies. Kesti formerly was group engineer in charge of missile valve and control component design and development at Chrysler Corporation, and design engineer in the missile valve and control component section of Redstone Arsenal, Huntsville, Alabama. He is a mechanical engineering graduate of Michigan College of Mining and Technology.

Ross Heat Exchanger Division of American-Standard has opened their new southeastern office at 522 N. McDonough St., Decatur, Georgia. **Fred M. Mahan** is manager of this new sales engineering office.

Najeeb E. Halaby has been appointed as vice president in charge of company development for **Servomechanisms, Inc.,** His responsibilities in the newly-created position will include the study of new areas of business activity for the company with a view toward its future diversification and expansion.

Richard P. Hempel has become manager of liquid filter sales for the **Dollinger Corporation,** Rochester, New York. Hempel formerly was an industrial engineer at Eastman Kodak Company.

An addition to the plant of the **Ajax Flexible Coupling Co., Inc.** in Westfield, N. Y. will double the production of the company's products. Located on the company's 22 acre site, the new one floor structure will include the newest machinery for efficient straight-line production.

Walther H. Feldmann, executive Vice President of **Worthington Corporation,** has been elected a member of the Board of Directors. Feldmann is also Board Chairman of Electric Machinery Mfg. Co., a subsidiary of Worthington.

S. G. Morris has been appointed distributor for **Sprague Engineering Corporation** and will cover northern Ohio. **A. M. Scriba** is northern Illinois representative and operates as the **American Fluid Power Company.**

The Denison Engineering Company, a wholly owned subsidiary, has become a division of the **American Brake Shoe Company**. Main offices are in Columbus, Ohio. Denison operates two plants, one in Columbus and one in Delaware, Ohio. **W. C. Denison** remains as president, **F. C. Norris** continues as vice president and general manager and **E. L. Fouse** becomes a vice president.

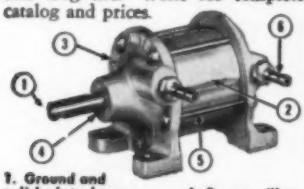
Continued on page 158

Circle 5 on Reader Service Card

AIR-MITE AIR CYLINDERS

Low Cost... Compact... Powerful... Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types

AIR-MITE Devices, Inc.

4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

Announcing

STEAM HOSE SWIVELS

Mayson has solved the problem of steam hose breakage with a swivel having Teflon packings and Teflon bearings. There is no rubbing metal contact.

For users of platen presses, drum driers and calenders we have good news.

Any Mayson distributor can help you on this item. Write for complete catalog.

MAYSON MFG. CO.

4332 HORATIO STREET • DETROIT 10, MICH.

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ARROW

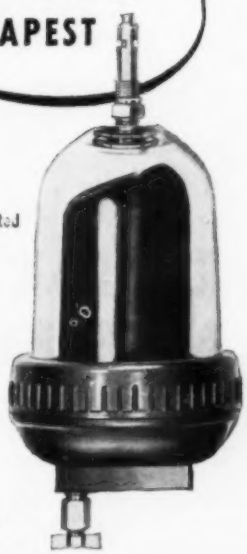
AUTOPNEUMATIC CONTROL

for Complete Conditioning and Control of Compressed Air for Powering Pneumatic Tools—Cylinders—Valves and Appliances.

PIPE LINE SIZES
¼"
⅜"
½"
¾"
1"

THE BEST IS CHEAPEST

AQUAMATIC DRAIN TRAP



- Automatically Drains Out Collected Moisture in Filter Bowl
- Visible Operation
- Non-Corrosive Parts
- Stainless Steel Valve
- Double Sump Action
- Valve Prevents Air Locks
- Adaptable to Any Make Filter with ⅛" NPT Drain Cock
- Can Be Connected to Floor Drain

QUALITY of PRODUCTS
SERVICE to CUSTOMER
RELIABILITY to INDUSTRY
Has been ARROW POLICY
Since 1914

ARROW engineers and field consultants at your service.
Catalog and engineering data on request.

ARROW TOOLS, INC.

1902 S. KOSTNER AVE. • CHICAGO 23, ILL.

Circle 12 on Reader Service Card

Post Scripts of Industry
continued

Bay Rubber and Plastics Corporation announced the opening of the new offices and plant of their Ohio O-Ring Division at 13110 Enterprise Avenue, Cleveland, Ohio.

James P. Malmstrom was appointed vice president of **United Aircraft Products, Inc.** He will continue as director of operations.

These announcements were made by **Vickers Incorporated: Gerhard Reethof** has been named chief of research and **LeRoy D. Taylor** as assistant chief engineer for Vickers, Detroit. **Ray C. Conner** assumes responsibilities as general manager of the new Automotive Division in Detroit. Assisting Conner as sales and service manager will be **John H. Baer.** In the Detroit regional industrial products sales office, **Robert G. White** has become application engineer. **Robert G. Harte** has been named application engineer for the company's Summit, New Jersey district sales office.

LeRoy D. Taylor
Vickers, Incorporated

Gerhard Reethof
Vickers, Incorporated

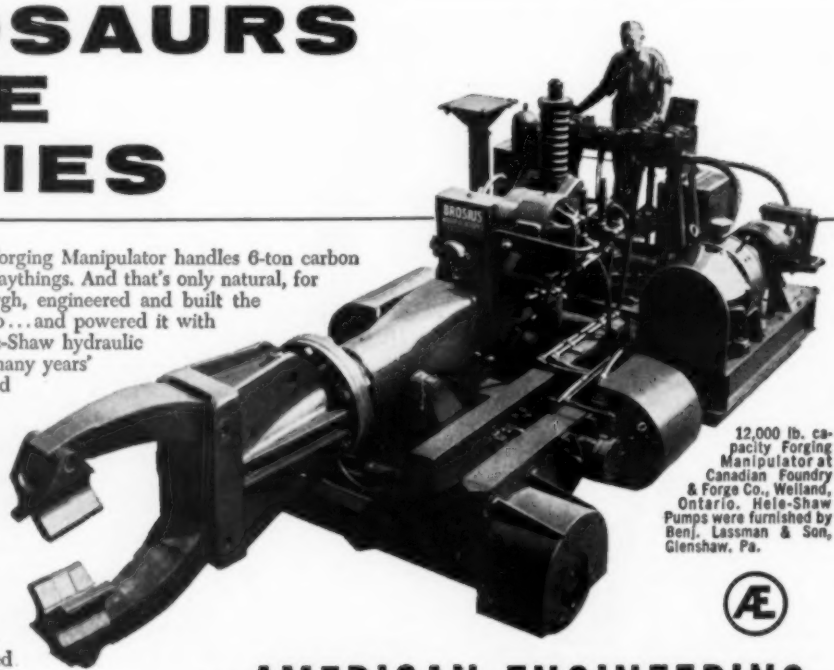
Ray C. Conner
Vickers, Incorporated

DINOSAURS WERE SISSIES

THIS AUTO FLOOR TYPE Forging Manipulator handles 6-ton carbon steel forgings as if they were playthings. And that's only natural, for Salem-Brosius, Inc., of Pittsburgh, engineered and built the manipulator to do a specific job...and powered it with a Hele-Shaw pump and a Hele-Shaw hydraulic motor. Salem-Brosius has had many years' experience with Hele-Shaws and thoroughly knows their outstanding efficiency and economy.

Hele-Shaw pump is a radial-piston variable displacement fluid power generator for pressures to 3000 p.s.i. Discharge can be varied from zero to maximum, and can be reversed instantly or gradually.

When ordering variable displacement hydraulically-operated equipment, specify Hele-Shaw for top dependability. Write for full information. Or, if you need a pump for constant displacement from 3 to 100 g.p.m., ask about the AE Hydramite.



12,000 lb. capacity Forging Manipulator at Canadian Foundry & Forge Co., Welland, Ontario. Hele-Shaw Pumps were furnished by Benj. Lassman & Son, Glenshaw, Pa.

AE

AMERICAN ENGINEERING COMPANY

DEPT. P-141, WHEATSHEAF LANE & SEPVIVA ST., PHILADELPHIA 37, PA.

Canadian Subsidiaries: Affiliated Engineering Corporations, Ltd. Montreal, P.Q. . . . Bawden Industries Ltd., Toronto, Ont.

AE products are: Taylor, Perfect Spread and Vibra-Grate Stokers, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers, Marine Deck Auxiliaries.

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MARSHALLTOWN

THE RIGHT GAUGE FOR YOUR SPECIFIC NEEDS

- PRESSURE
- VACUUM
- COMPOUND
- ALTITUDE
- COMBINATION
- DIAPHRAGM
- HYDRAULIC
- AND SPECIAL PURPOSE GAUGES
- DIAL THERMOMETERS

(Vapor Tension or Bi-Metal)

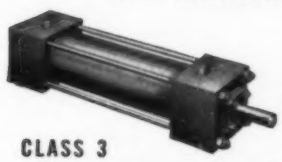
• Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

WRITE TODAY FOR COMPLETE INFORMATION

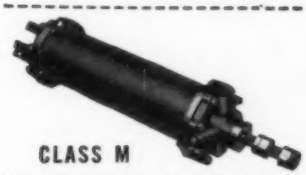
MARSHALLTOWN MANUFACTURING CO.

800 EAST NEVADA ST.
Marshalltown 4, Iowa

NOPAK Hydraulic Cylinders
in 3 Classes of Construction



CLASS 3



CLASS M

CLASS 4

Representatives in Principal Cities

For the Efficient Application of Fluid Power

NOPAK Cylinders for oil or water hydraulic service at line pressures from 450 to 2000 PSI are available in 3 classes of construction to meet your varying needs:

CLASS 3 — Square Head with Tie Rods — Latest addition to the NOPAK Cylinder line . . . Compact construction with square heads of steel plate. Honed steel tubing. Nominally 1000 PSI —to 1500 PSI in the smaller diameters. Dimension Data Sheets now available.

CLASS M — *Mill or Mine Type* — Rugged steel tubing with welded flanges eliminates tie rods. Heads attached to flanges by cap screws or thru bolts. Recommended for all *heavy duty* applications at line pressures up to 650 PSI. Write for Catalog 101.

CLASS 4 — *High pressure Hydraulic* — Heavy honed steel tubing with lock-ring flange. For oil or water hydraulic service at pressures to 2000 PSI. Write for Catalog 104.

GALLAND-HENNING NOPAK DIVISION
2743 SOUTH 31st STREET • MILWAUKEE 46, WISCONSIN

NOPAK
VALVES and CYLINDERS
for AIR and HYDRAULIC SERVICE

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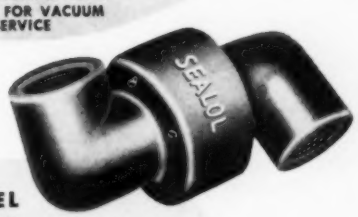
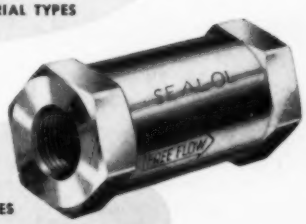
Announcing
New SEALOL Hydraulic Products

ROTARY JOINTS BULLETIN 14
BALANCED PRESSURE • LOW TORQUE • LEAKPROOF
PRESSURES: Steam to 150 PSI — Fluids to 350 PSI
SPEEDS to 1750 RPM
TEMPERATURE to 425°F
DESIGNED FOR VACUUM SERVICE



SWIVEL JOINTS
BULLETIN 15
LIQUIDS • VAPORS • GASES
PRESSURES to 3500 PSI
TEMPERATURE to 350°F
AIRCRAFT & INDUSTRIAL TYPES



CHECK VALVES
BULLETIN 16
VAPORS • LIQUIDS • GASES
PRESSURES to 3000 PSI
TEMPERATURE: −65° to +350°F
LOW PRESSURE DROP • FULL FLOW
POSITIVE CHECKING
AIRCRAFT & INDUSTRIAL TYPES

Sealol combines years of experience in mechanical sealing and hydraulics engineering to meet industry's demand for dependable fluid transfer devices. SEND FOR DESCRIPTIVE BULLETINS.

SEALOL CORP
181 POST ROAD, PROVIDENCE 5, R. I.

Boston • New York City • Philadelphia • Washington • Buffalo • Pittsburgh
Cleveland • Greenville, S. C. • Jacksonville • Milwaukee • Chicago
Kansas City • Tulsa • Denver • Los Angeles • San Francisco • Toronto, Canada

SEALOL
THE BALANCED PRESSURE SEAL

Circle 119 on Reader Service Card

Post Scripts of Industry
continued

Gerotor May Corporation is constructing a new plant and office building on a 26 acre site in Owings Mills, Maryland. The one-story structure will comprise approximately 64,000 square feet. The entire plant, expected to be ready by December, will be operated on an in-line production basis using high-speed, high-production machine tools.

Andrew B. Huntington has been named chief engineer of **Ross Operating Valve Co.** of Detroit, Mich. He joined the company in 1952 as manager of production engineering. Huntington

Andrew B. Huntington
Ross Operating Valve Co.

has been a project engineer for U. S. Rubber Co. in Naugatuck, Conn., and assistant plant superintendent of Lalance & Grosejean Manufacturing Co. in Woodhaven, N. Y. He is a graduate of Yale University School of Engineering.

The Shenango-Penn Mold Company of Dover, Ohio has been consolidated into the parent organization, **The Shenango Furnace Company** of Pittsburgh, Pa. As a result, the Dover, Ohio operation will be known as the company's Centrifugally Cast Products Division.

Lear Incorporated's Lear-Romec Division at Elyria, Ohio, has constructed an addition to their plant which will increase its total space to nearly 74,000 sq. ft. The new addition houses an electric motor production line as well as heat treating, testing and inspection facilities.

ready-made to your specifications

GAR HYDRAULIC RESTRICTORS

Whatever your restrictor requirements, chances are Gar already has units with the characteristics you're after. Gar hydraulic and pneumatic restrictors come in one-way and two-way types, and just about every other type, size and rating you can imagine. But, should you ever ask for special characteristics in pressure, flow, weight, temperature or envelope size that aren't standard at Gar, you'll never know, because we'll produce what you need in the same short delivery time, at the same low price.

Some extras that might interest you, too, for special applications are self-cleaning designs that work, and electroformed orifices that are unique for highest precision and absolutely identical flow characteristics.

But right now, the important thing is to call Gar. After that, you can leave the rest up to us.

RESTRICTORS ★ REDUCING VALVES ★ RELIEF VALVES ★ FILTERS ★ SNUBBERS

To cover a full range of temperatures, pressures, sizes

Send today for full information **GAR PRECISION PARTS, INC.**
3 LUDLOW STREET, STAMFORD, CONNECTICUT

Racine Hydraulics & Machinery, Inc. announced the appointment of **Robert C. Tessmer** as a sales engineer in its Hydraulic Division. Tessmer was formerly associated with Nordberg Manufacturing Company of Milwaukee.

Robert C. Tessmer
Racine Hydraulics & Machinery, Inc.

B. B. Flick, formerly lubrication engineer for the Detroit division of **E. F. Houghton & Co.,** has been transferred to the Pittsburgh Steel Mill Division in charge of sales and service.

Jas. P. Marsh Corporation has opened their New England office at 27 Temple Street, Quincy, Mass. **Mansur Storrs** is representative for Maine, Vermont, New Hampshire, Rhode Island, Massachusetts and Connecticut, and will operate from the new office.

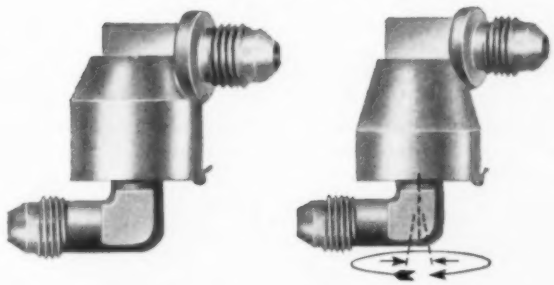
Mansur Storrs
Jas. P. Marsh Corporation

L & L Manufacturing Company of Van Dyke, Michigan has opened new manufacturing facilities at 22349 Groesbeck Highway, East Detroit, Michigan.

Continued on next page

only BARCO offers both!

STANDARD TYPES



PLANE SWIVEL JOINT— 360° rotation in a single fixed plane.

SELF-ALIGNING SWIVEL JOINT— 360° rotation *plus* 15° side flexibility.

these 2 basic BARCO joints bring flexibility unlimited to piping and tubing

Since 1941 Barco Swivel Joints and Flexible Assemblies have met the precise requirements of in-flight and other types of military equipment . . . *conforming to MIL-J-5513A and other specifications.*

This wide experience is yours to call upon in the development of your particular project—aircraft, missile, track vehicle or special installation—for hydraulic, pneumatic, oxygen, fuel, gas or liquid service. Barco Representatives are at your service in the specification of standard or specialized adaptations of standard designs.

SPECIAL DESIGNS

WING FOLD HYDRAULIC ASSEMBLY

DOUBLE HYDRAULIC JOINT ON MILITARY TANKS

TRUNNION JOINT LANDING STRUT ASSEMBLY

AIRCRAFT BRAKE LINE JOINT

SEND FOR NEW CATALOG 269-A —gives details on Barco swivel joints and their application to many types of flexible assemblies.

BARCO *Serving Industry Since 1908*
MANUFACTURING CO., 532-M, Hough St., Barrington, Ill.
AIRCRAFT DIVISION

Post Scripts of Industry
continued

A. King McCord has been named president of **Westinghouse Air Brake Company**, succeeding E. O. Boshell who has been serving as both chairman of the board and president since 1951. Boshell remains as chairman of the board. McCord has been president of the Oliver Corporation since 1950, having served this firm in various executive capacities since 1930.

A. King McCord
Westinghouse Air Brake

G. H. Rearick, Milwaukee plant manager of **The Babcock & Wilcox Company's** Tubular Products Division, has been named to the staff as company vice president W. J. Thomas. Norman E. Wenzel will succeed Rearick as plant manager.

Automatic Switch Company's Pacific Coast Factory Branch has moved to larger quarters at 1233 Goodrich Boulevard, Los Angeles, California.

Appointment of **O. B. Wilson** as vice president of the **Brown Instruments Division** of Minneapolis-Honeywell Regulator Company was announced. Wilson also continues in his current post as general sales manager for the division.

Appointment of **E. A. Williams** as vice president and general manager of **H. W. Loud Machine Works, Inc.** has been announced. Williams comes to Loud after

E. A. Williams
H. W. Loud Machine Works, Inc.

more than 14 years experience in top level planning and production at Lockheed Aircraft Corp.

The Cross Company has named **R. T. Johnstone** as assistant sales manager. Johnstone joined the company in 1954.

Continued on page 164

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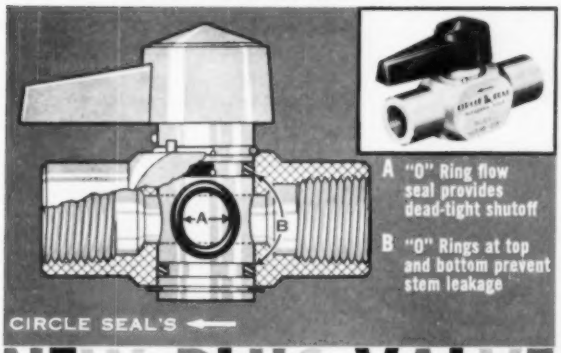

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Post Scripts of Industry
continued

Sumner L. Barton has been appointed sales engineer for **Control Engineering Company** of Detroit. Barton will maintain a Chicago office at 6018 Longview Drive, La Grange, Illinois, handling sales for the midwest area.

H. W. Loud Machine Works, Inc., Pomona, California, has named **Nicholas M. Esposito** to fill the newly created post of production manager. Esposito was formerly with Axelson Mfg. Company's aircraft division.

James W. Perry has been appointed industrial application engineer for the Chicago District Office of **Vickers Incorporated.** He will provide design, development and application assistance

James W. Perry
Vickers, Inc.

to users of industrial oil-hydraulic systems in the Chicago area. Perry was a sales representative for a manufacturer of metal finishing equipment before joining Vickers in 1955 in the main office sales department in Detroit.

Parker Appliance Company has announced the appointment of two new distributors. **Hydraquip Corporation,** 6645 Navigation Boulevard, Houston, Texas will service the Gulf Coast area. **Swan Engineering & Supply Co., Inc.,** 3251 Fairfax Road, Kansas City, Kansas, will cover the Missouri-Kansas territory.

Appointment of **Phillip Hall** as industrial sales promotion manager was announced by **A. Schrader's Son Division of Scovill Manufacturing Company, Inc.** Hall was formerly a sales engineer for this division.

Phillip Hall
A. Schrader's Son Division
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Blackhawk Manufacturing Company's Hydraulic Control Division now operates as **Dynex, Inc.** with headquarters at 1500 South Muskego Avenue, Milwaukee, Wisconsin. The tradename "Blackhawk" will be retained.

H. J. Andreson is sales manager of **Hannifin Corporation's** new **Crown Products Division,** reporting to **O. J. Maha,** company vice president. Crown products are being offered through stocking distributors, including J. N. Fauver Company, Inc., The Rucker Company and Nielsen Hydraulic Equipment, Inc.

H. J. Andresen
Crown Products Division
Hannifin Corporation

O. J. Maha
Hannifin Corporation

Square D Company has named **Walter Nollenberger** manager of a new plant in Lexington, Kentucky, and **Stephen Kovach** manager of an assembly plant in Atlanta, Georgia. Nollenberger has been chief manufacturing engineer of the distribution equipment division and Kovach has been supervisor of industrial engineering in Royal Oak, Mich.

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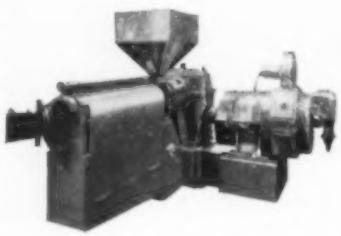

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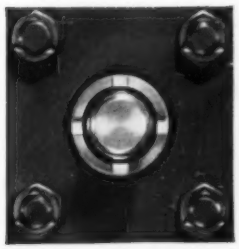

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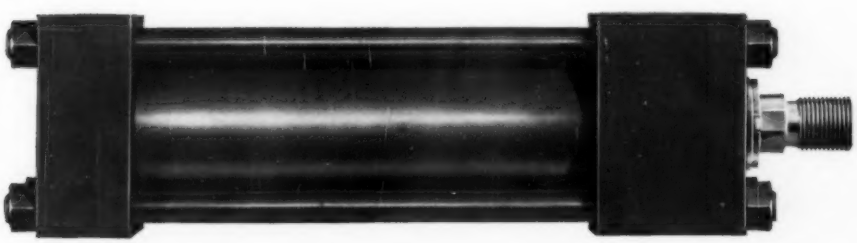

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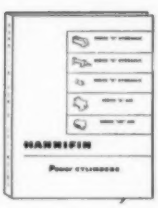

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25 QUICK GUIDES TO PRODUCT SELECTION

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CHARACTERISTICS DESIGNERS NEED TO KNOW

The chart for each of the twenty-five products will list what companies make the product and will indicate the important specification characteristics.

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